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Frederic R. Stearns

CHEMICAL & METALLURGICAL ENGINEERING

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H. C. PARMELEE, Editor

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The Blight of Politics In Government Technical Bureaus

IN THE summary dismissal some months ago of Arthur Powell Davis as director of the Reclamation Service in the Department of the Interior, Secretary Work dealt a blow that has seriously disturbed the customary tranquillity of engineers and technical men in government service, so far as the security of their jobs is concerned. The incident is worth recounting, even though it does not relate directly to chemical engineering, because Secretary Work is at the head of a department in which are other scientific and technical bureaus that might experience similar treatment, much to the distress of the chemical engineering industries. The removal of Arthur Powell Davis, engineer of good repute and long experience, was accompanied by the appointment of David W. Davis, politician out of a job. Thus was insult added to injury. Secretary Work gave as his reason that the position called for "business rather than engineering ability," though he can hardly justify his act on that score, as the records of the two men disclose.

Arthur Powell Davis began in 1882 as topographer to the Geological Survey at $720 a year. In 1895 he was appointed hydrographer and his salary was made $2,200. In 1902 the Reclamation Service was established and he was made its principal engineer at $3,500. When his resignation was requested in June last he was its director at a salary of $7,500. He has been president of the American Society of Civil Engineers, has constructed more than 100 storage dams and has converted more than 3,000,000 acres (an area greater than the State of Connecticut) from desert to irrigated lands with a production valued at $50,000,000 annually. He made the hydrographic studies for the Panama Canal, was sent to Russia to study problems connected with the restoration of ancient irrigation works near Turkestan, and as a member of the American Red Cross Commission was sent to China to study Chinese flood control problems. Congress appropriated $6,000,000 to build the Arrowrock Dam, but under him it was completed for $5,000,000 and in a year's less time than the original estimate, due to his engineering strategems and economies. When the Roosevelt Dam was built, cement cost $7 a barrel. He constructed a government-owned plant and got his cement, including depreciation and all other charges, for $3.14 a barrel. These are merely a few of his achievements. So well is his engineering talent thought of that within 2 months of his dismissal from the government service he is said to have made fees equal to a year's salary in his former position. We do not know his politics.

David W. Davis, who was selected by Secretary Work to succeed Arthur P. Davis and for whom the Secretary secured dispensation from any civil service examination (for obvious reasons), has the following history, according to a recent number of *Good Government*: He was a coal miner, clerk in a coal company, cashier of two small Western banks and finally "organizer and president of the First National Bank of American Falls, Idaho." The bank subsequently was consolidated with another and failed, and its failure was attributed by L. L. Evans, president of the institution, to the business policies followed by the First National while David W. Davis was its president. Since then he has been in politics as Governor of Idaho and as unsuccessful applicant for Civil Service Commissionership at $5,000 a year, until finally Dr. Work took him on in the Reclamation Service at $7,500. He is reported to be a staunch Republican.

Now government bureaus of technology and engineering are of immense value to the people. The relations of the Bureaus of Mines, of Standards and of Chemistry in the Department of Agriculture to chemical industry are of supreme importance. Here problems of vital moment in research are undertaken, many of which are clear beyond the scope of industrial and academic laboratories. Men of eminence are engaged there at small salaries, the posts being attractive to them because they are able to carry a life work to completion under the most favorable conditions. These conditions have lasted through many years, anu they have established a remarkable *esprit de corps*; have engendered that subtle but triumphant power of co-operation without which progress in engineering and technology is well-nigh impossible. For this we have to thank a long line of Cabinet officers of both parties who were men of forethought and character. They kept the bureaus free from politics.

But this act of the Secretary of the Interior has done more to destroy the faith of the men at work in the government bureaus at Washington than anything that has happened for years. It is not the Reclamation Service alone that is stricken, but every other scientific department of the government. What's the use, they ask, in undertaking big things if any day one's place is likely to be filled by some hack politician, who knows nothing about the work, who can't possibly achieve results and who can only fuddle along and draw his salary? If one Cabinet officer will do a thing like that, how many others are likely to follow suit? The *esprit de corps* of every one of the bureaus has been strained almost, if not quite, to the breaking point.

We do not question Dr. Work's motives. Doubtless he means all right in finding a job for his old political friend. But the cost of it all is too great for those of us who are interested in the scientific development of the United States to endure it with complacency. Dr. Work should seek better advisers.

Safety-First Methods In Plant and Laboratory

THE recent tragic death of Dr. Sergio Bagnara in the laboratory of the California Cyanide Co., at Huntington Park, Los Angeles, should focus attention on the need for adequate measures against a recurrence of what the jury decided was an accident. Dr. Bagnara was sucking a tube or pipette, which he wished to fill with a dilute solution of sodium cyanide, when some of the liquid passed into his mouth. Realizing the possibility of danger from poisoning, he probably spat out the solution. Then, to make sure, he bethought himself of an antidote. He called to a colleague for a glass, which he almost filled from a nearby bottle marked H_2O_2. After drinking about half of this at one gulp he died almost instantaneously. Despite the label, the bottle contained a strong solution of calcium cyanide!

The episode is pregnant with warning. The neglect to use a safety float pipette or an aspirator when measuring working cyanide solutions of this character has failed to cause thousands of deaths only because of the small percentage of cyanide present. Although no single ordinance will prevent untoward happenings, no prospect of reducing the hazard should be overlooked. Drinking from a reagent bottle in a laboratory devoted to research on deadly poisons is a practice the stupidity of which it should be unnecessary to stress. Assistants might well be impressed with the need for a strict observance of a rule to this effect.

In the present instance, however, it may be affirmed with logic that death occurred because no proper antidote was available. In spite of every precaution and care, in spite of the observance of rules and regulations, accidental poisoning will occur; antidotal measures must constitute an essential element of a safety-first program. In this connection it is interesting to note that one of the officials of the company is reported to have stated at the inquest that he had never heard of an antidote that would be quick enough to counteract cyanide poisoning. "That," he continued, "is why no antidotes are kept in cyanide plants, as a rule."

Generalizations of such a nature are exceedingly dangerous. The provision of emergency equipment in cyanide plants, to counteract the effects of poisoning, has been adopted extensively; a neglect in this respect is generally due to an absence of accidents over several years and a forgetfulness of the penalties of carelessness or ignorance; it is usually maintained that no danger exists if intelligent caution be observed. To this viewpoint we make emphatic protest. There can be no excuse for not providing against the emergency that arises when the fear of imminent death robs an intelligent man of calm reasoning powers and reduces an individual of low mentality to a pitiable condition of dependence on others. We insist that antidote cabinets, in bright colors, with the essential chemicals in breakable tubes, strainer cup, mouth gag and rubber tubing, should be placed in conspicuous positions in cyanide plants and laboratories where the poison is used extensively in dissolved form. Hydrogen peroxide is of doubtful value; freshly prepared ferric hydrate should be available. We deprecate the attempt to minimize the value of such an antidote if administered properly and promptly. Solutions used in hydrometallurgy and on which control work is done in the laboratory are usually weak in cyanide; the amount of poison taken internally in 99 accidents out of 100 is exceedingly small. The ferric hydrate antidote has been proved efficacious on innumerable occasions; it is logical, therefore, to insist that precaution should be taken and that employees in and around a plant should be familiar with the use of the apparatus needed to prepare and administer the antidote without loss of time. The display of emergency cabinets is a constant reminder that danger exists, prompting employees to be on their guard and breeding intelligent curiosity among those who are ignorant of the chemistry of the reactions involved. To underrate the value of an antidote in ordinary cases of cyanide poisoning, such as the first phase of the tragedy that recently occurred as Los Angeles—the taking into the mouth of a small quantity of a weak solution of cyanide—is to deprive the chemist and the operator of all hope of recovery in the event of such accident.

Changes in the Railway Situation

NOT a great many months ago we were hearing a good deal of complaint about the railroads, about late deliveries that were due to an intangible condition which we called "the car shortage." Lately there has been a tendency for us to forget that we were ever bothered with a transportation problem. Shippers have been able to get their freight cars loaded and moved as rapidly as they have desired. Incidentally we have heard that the railroads are now handling a larger volume of traffic than ever before in their history, but few of us have thought seriously of what has brought about this remarkable change in the situation.

Here are some of the reasons as Samuel O. Dunn, editor of *Railway Age*, set them forth when he recently reviewed the railway situation before the National Conference of Business Paper Editors. During the first 8 months of this year 116,000 new freight cars have been put into service, along with 2,583 new locomotives. This year's bill for new equipment and other improvements will considerably exceed one billion dollars. Since 1920 the railways have succeeded in increasing the average daily mileage of each freight car about 4 miles, or 16 per cent. In addition, they have increased the average number of freight cars in each train and at the same time increased the speed. Thus it may be said the entire railway machine has been speeded up.

These improvements have been made at a time when the roads have constantly been harassed by threats of radical legislation. There has been a persistent demand on the part of the farmers for immediate reduction in freight rates. This has been echoed by a certain class of politicians whose plaint has been that the valuation placed on the railroads by the Interstate Commerce Commission is greatly excessive. Some of them are demanding that this be reduced by at least a third. As Mr. Dunn pointed out, however, even such a drastic reduction in valuation could reduce freight rates by only 5 per cent, since all but 15 per cent of the total earnings are now absorbed in operating expenses and taxes—items that obviously would be unaffected by any change in valuation basis.

The sounder policy and the one that appears to have

the support of the industrial shipper is to let the railroads work out their own salvation. If they can continue the splendid improvement made during the past few months, in a short time they will have acquired ample facilities to handle the increasing requirements of commerce. Furthermore, the new equipment and greater operating efficiency should reduce operating expenses to such an extent that a reasonable revision of rates can be made without disastrous effect on our transportation system.

Technical Treatises And Their Preparation

A FRIEND of ours writes at length commending us for publishing a frank expression of opinion on a recently issued textbook and deploring the appearance of so many treatises that are mediocre or worse. He confesses to having developed a cynical attitude toward the efforts of technical authors in general, having discovered, to his cost and discomfiture, the falsity in the refrain of that old song: "It must be right because it's in the book." Many technical treatises are misleading and incorrect; and our informant complains that too often the author, in his desire to acquire fame by an inexpensive method, takes no pains to verify his statements. In many instances he is a theoretical man writing on a practical subject, and the results are not difficult to imagine. It is averred that too much appears that merely constitutes a rehash of what has been written before, possibly with no regard for that standard of accuracy which should characterize all scientific effort.

We find ourselves in sympathy with the views of our correspondent and believe with him that both an editor and a reviewer should be unafraid of telling the truth, and that it were better not to print a review that praises or lacks critical comment of what is unworthy. However, there are two sides to every question, and the remarks in the letter before us prompt sundry comments in an effort to emphasize the value of constructive criticism. In the first place, we believe that any serious effort to restrict initiative in writing for publication would ultimately prove detrimental to scientific and technical progress. Let us teach accuracy and a wholesome regard for truth, by all means; but the tyro should be encouraged, whatever his motives for seeking publicity for his ideas. Practice makes perfect, and perfection cannot be attained without practice. Therefore it is obvious that every writer must undergo an apprenticeship to realize the importance of accuracy and to learn the fundamentals of ethics. Absolute correctness in anything is unattainable or almost unattainable, and the greatest achievement usually follows the realization of a mistake, to make which we are all prone.

An experienced traveler once remarked that he could always learn something of value from a fellow man, so he encouraged conversation, even with the most unlikely casual acquaintances. It is the same with books. Very few are barren of inspiration, although many educate in a manner entirely different from the way the author intended, for they teach us what to avoid. But good or bad, all should serve as stepping stones to better effort, better appreciation of the niceties of technical journalism and more wholesome reverence for scientific fact. It is usually the first effort that disappoints. A harsh corrective to insure improvement is a critical review. But as our correspondent points out, comparatively few people take cognizance of such individual comments, largely because of the rare appearance of an adverse criticism. We suggest that the remedy for the state of affairs that distresses and misleads so many earnest students is to insist that authors shall serve an apprenticeship as contributors to the technical and scientific press before embarking on the more serious project of book publication. Thus and thus only will it be possible to avoid the pitfalls that must be dodged by the inexperienced, to appreciate the work of others, to acquire a respect for just criticism and to become proficient in the proper presentation of technical and scientific data.

Taking an Incentive Out of Research

RESEARCH, in contrast to manufacturing and production, is largely the work of individuals. In industry, to be sure, a company's name may in time become associated with a general trend of investigation, but practically always the credit for scientific advance goes to the individual worker. This is as it should be. Science is essentially democratic and any attempt to substitute mass effort for individual initiative must eventually spell defeat for scientific progress.

There appeared on the program of the Dayton meeting of the American Electrochemical Society a paper entitled "The Disappearance of Gas in the Electrical Discharge," which was presented in the name of "the Research Staff of the General Electric Co., Ltd., of London." The omission of individual credit in the authorship of the paper apparently passed without comment from the great majority of members at the meeting. Yet there was at least one present who had the courage to register a protest. This member, who incidentally is one of this country's most distinguished scientists, has summarized his objections in these three sentences: "(1) All scientific literature is based on personal responsibility by the authors. (2) All credit for scientific work must be given largely to individual authors. (3) Any attempt on the part of companies to suppress the individuality of their research workers can only result in a detriment to scientific research in general and particularly to the status of their research men."

Carried to its logical conclusion, this policy of the British company would entirely obliterate the identity of its research workers as individuals. Robbed of their chief incentive for scientific achievement, they would become mere automatons turning out machine-made research in accordance with company dictation and the exigencies of commerce. Fundamental inquiry would give way to the sordid pursuit of immediate gain and it would not be long before the whole research structure would topple for want of adequate foundation.

Perhaps we paint the picture too black, but certainly this is a movement that is not in the direction of progress. Our societies and technical organizations—in fact all who have the interests of science at heart—would do well to make certain that this withering influence is not allowed to invade our own great institutions of industrial research.

What Is Ciment Fondu?

A Few Notes on This Interesting Material That Has Recently Assumed Considerable Industrial Importance and on Its Probable Future

"Ciment Fondu"

Is it a name to conjure with or will it become a minor article of commerce? Of course, any prediction is somewhat of a gamble, but certainly the prediction of a man familiar with the material and its use, acquainted with the economic background and well grounded in the general field of its possible industrial service will be of more value than the random guess of Anyone. Therefore, we have turned to Major Edwin C. Eckel for an opinion on ciment fondu.

OCCASIONALLY there develops in an industry something new and revolutionary that threatens to overthrow the existing status. Perhaps it does not quite reach that point. It may simply loom large, but be prevented from threatening seriously by a couple of capable "Ifs." That is practically the situation with alumina cement, variously known as ciment fondu, Alciment, ciment electrique, etc. Although this material has been known and manufactured in France since 1908, it never attracted serious attention until its great utility in the World War became familiar. Recently many less informed people have begun to worry and wonder and talk about the revolution that is likely to take place in the cement industry: "A new and wonderful material has been discovered that would displace portland cement," and so forth.

Now it so happens that a well-known consulting engineer, Major Edwin C. Eckel, during the war had been in charge of a post in France where this material was both manufactured and used. So when he was in New York not long ago he was asked to give us an opinion on this material and to discuss its industrial utility.

Parenthetically it can be said with certainty that in any industry that has attained the magnitude of the portland cement industry it is impossible for a serious revolution to take place overnight or in a few years. No other reason is needed than that it would take a long time to accumulate the hundreds of millions of dollars necessary for capitalizing a competing product.

But to return to ciment fondu. Let us listen to Major Eckel: "Ciment fondu is made by fusing bauxite and limestone in an electric furnace and subsequently grinding the material to a powder. Of course such a statement is intentionally but the barest intimation of the nature of the process, which in its technological development is somewhat of a secret. The product itself is a mixture of calcium silicate and calcium aluminate.

"The principal utility of this new product is built around its remarkable quick-setting property. Whereas it requires 28 days for portland cement to reach maximum hardness, ciment fondu will reach an equivalent hardness in about as many hours. But this remarkable property is limited in its wide employment by the price of the material. At present it markets for approximately three times the price of portland cement in Paris and its present production in France is about 7 per cent of the total portland cement output.

"The chances for its becoming a cheaper commodity commercially are not bright and the industrial uses will largely be confined to those in which the added cost will be more than counterbalanced by the desirability of rapid hardening or some other of its properties."

At present it is used in Paris in subway repairs and construction and in repairing paving on the important thoroughfares and street crossings, where its quick setting properties cut down the tie-up of traffic by nearly 3 weeks.

To production men in the chemical engineering industries a feature of this new product that may prove of great service is the resistance that it shows to chemical attack. The extent and details of this resistance are not well known as yet, but it is likely to show great resistance to alkaline solutions. In any case it is a material that will bear watching for the construction of vats both for storage of materials and for carrying out chemical reactions.

What Becomes of Second-Grade Lemons?

Citric Acid

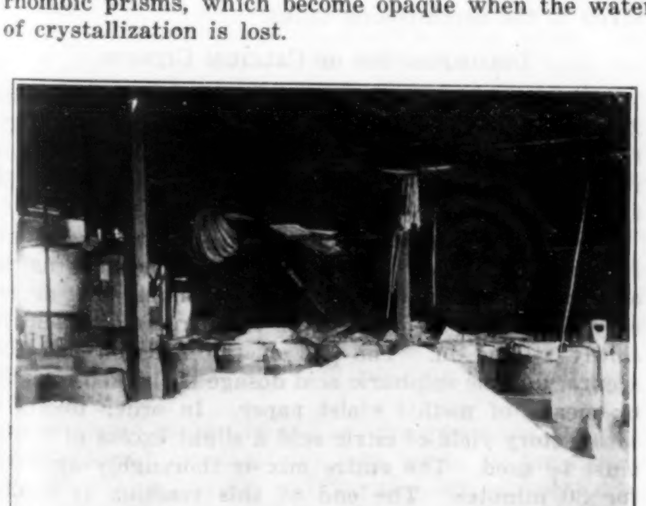
The Story of an Important Chemical Industry Developed in an Attempt to Salvage Fruit That Otherwise Would Be Wasted or Inefficiently Utilized

By C. P. Wilson
Chemist in Charge of Research,
California Fruit Growers Exchange, San Dimas, Calif.

CITRIC ACID is found in many fruits, especially in those of the citrus variety. The percentages of acid in the juice of such fruit, as grown in California, are as follows: Orange, 1 to 1.6; grapefruit, 1.2 to 2.4; lemons, 5 to 7 per cent.

Detailed information on the content of citric acid in California lemons has been given by E. M. Chace, C. G. Church and C. P. Wilson in Bulletin 993, U. S. Department of Agriculture. It was shown by H. D. Young (*Ind. Eng. Chem.*, vol. 7, p. 1038) and by H. S. Bailey and C. P. Wilson (*Ind. Eng. Chem.*, vol. 8, p. 902) that the citric acid of lemons is seriously injured when they are affected by frost, that frost-injured lemons are suitable for the recovery of citric acid, but that the yield is much less from frozen than from unfrozen lemons. The amount of citric acid in oranges and grapefruit is insufficient to pay the cost of recovery.

Nearly all the citric acid in lemons occurs in the free state. H. D. Poore, of the U. S. Department of Agriculture (*Ind. Eng. Chem.*, vol. 15, p. 775) has crystallized citric acid directly from lemon juice after removal of most of the impurities (such as sugars and pectin); but in commercial practice it is invariably separated from the juice as calcium citrate, which, on decomposition with sulphuric acid, yields free citric acid again in crystallizable form. The crystals are transparent rhombic prisms, which become opaque when the water of crystallization is lost.



CITRIC ACID READY FOR SHIPMENT

The two principal reactions involved in the recovery of citric acid are:

Citric acid + milk of lime → calcium citrate + water
Calcium citrate + sulphuric acid → calcium sulphate + citric acid

The lemons used are those that are not fit to ship. The average distance a California lemon has to travel to reach the ultimate consumer is about 2,500 miles; and only sound fruit of good appearance and quality justifies the expense of packing and shipping. Fruit that is misshapen, undersize, wind-scarred, thorn-pricked, clipper-cut or otherwise injured or deformed is not fit for shipment; it finds its way into the cull bins and from there to the citric acid plant.

Washing and Pressing

The fruit is shipped by truck, or is loaded in box cars to a depth of 3 or 4 ft. On arrival at the factory it is shoveled into a hopper that drops it into the washer—a wooden tank, 4 to 6 ft. wide by 3 ft. deep by 12 ft. long, with a slowly rotating wooden shaft operating beveled wooden paddles that move the lemons through the water to an elevator that carries them to the presses.

The lemons then pass through heavy bronze rollers to remove the bulk of the juice. From the rolls the pressed pulp is conveyed to a wash box similar to the one used in handling the lemons. Here it is saturated with water and passes to a continuous screw press to effect a second extraction of acid. These presses are made by the California Press Manufacturing Co., of San Francisco; all parts that come in contact with the fruit or juice are made of acid-resisting bronze. Two or three extractions are made, depending on such factors as the condition of the fruit and the price of citric acid.

The combined expressed juices are collected in wooden tanks each of a capacity of 40,000 to 130,000 liters, the total storage at the Exchange company's plant at Corona, Calif., being about 1,000,000 liters. In these it is allowed to undergo spontaneous fermentation, requiring 3 to 5 days in summer, but longer in winter. This stage of the process must not be allowed to go beyond the point where the sugars are completely fermented, otherwise the yeasts attack the citric acid. The fermentation is necessary if the juice is to be filtered, as is invariably done at the plant described. If the juice is handled fresh, the albuminous fine pulp present clogs the filters rapidly, even though a filter aid is used.

Filtering and Precipitation

Filter-Cel is added to the juice in the proportion of 8 to 10 lb. per 100 gal. The mixture is agitated while being brought to a boil, then filtered through wooden

plate-and-frame presses. Open-delivery, washing-type, 30- and 36-in. Sperry and Shriver presses are used.

Filtered lemon juice is brilliant, with a light amber to straw color. If filtered without dilution, it usually contains about 5 to 6 per cent of citric acid; juice diluted with the second and third extractions from the pulp in the step-up process contains about 3 per cent citric acid. The filtered juice is run while hot into round precipitating vats, made of wood (3-in. Douglas fir), 230 cm. diameter and 255 cm. deep, with a working capacity of 8,500 liters. Each is provided with an agitator and a copper heating coil.

Each vat is numbered and calibrated. Instead of measuring the depth of the liquid, the operator measures the distance in centimeters from the top of the vat to the surface of the juice, and a table of capacity gives the number of liters in the charge. A sample is sent to the control laboratory, with the measurement; and from a simple titration to phenolphthalein the amount of citric acid in the batch is calculated. From tables the operator estimates the amount of calcium hydroxide and calcium carbonate necessary to precipitate the citric acid as calcium citrate.

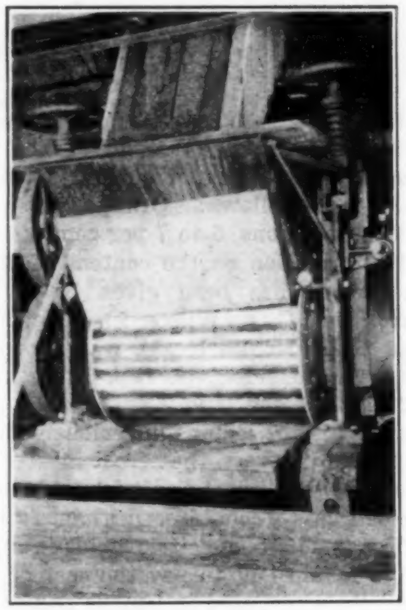
Sufficient calcium hydroxide, as milk of lime, is added to neutralize about 90 per cent of the total acid present, then sufficient calcium carbonate to neutralize the remainder of the acid and also an excess of calcium carbonate equivalent to about 10 per cent of the total acid present. Experience has demonstrated that if the juice is completely neutralized with $Ca(OH)_2$ the coloring matters, gums, pectin and other substances will be precipitated or adsorbed, and dark-colored acid liquors will be obtained on decomposition of the citrate with sulphuric acid.

It has been further shown that if only calcium carbonate is used, the solution will remain distinctly acid, even after all CO_2 has been removed by boiling. An excess of $CaCO_3$ is therefore necessary to insure an almost complete recovery of the citric acid in the citrate, and the neutralization must be completed with

LEMON CONVEYOR AND WASHER
CRUSHING ROLLS

the carbonate instead of with the hydroxide, to insure a clean white citrate. The use of calcium hydroxide prevents much troublesome frothing.

It may be noted that although pure crystallized calcium citrate is white and contains 73.7 per cent of crystallized citric acid, the usual imported product is brown and contains an average of 64 per cent citric acid. The product made at Corona is almost white and averages about 68 to 69 per cent citric acid. This is



CONTINUOUS SCREW PRESS

because the juice is filtered before precipitation and the neutralization is controlled carefully.

The calcium citrate is filtered and washed on Oliver filters and discharged into a hopper, from which it is taken to the decomposing tanks.

Decomposition of Calcium Citrate

Decomposition of the citrate is carried on in tanks 230 cm. diameter by 152 cm. deep, equipped with agitators but not provided with heating coils, as this reaction is carried out cold to reduce the solubility of the calcium sulphate.

About 1,100 kilos of citrate is suspended by agitation in dilute acid liquor obtained from the previous batch, and the amount of 66 deg. (Bé.) sulphuric acid necessary to convert all the citrate into free citric acid is slowly stirred in. The end of the reaction and the accuracy of the sulphuric acid dosage is checked roughly by means of methyl violet paper. In order to get a satisfactory yield of citric acid a slight excess of H_2SO_4 must be used. The entire mix is thoroughly agitated for 30 minutes. The end of this reaction is finally checked by filtering some of the clear liquor and adding to 5 c.c. of this an equal volume of 45 per cent $CaCl_2$ solution. In the presence of 0.2 per cent H_2SO_4 a faint but definite precipitate of $CaSO_4$ will be noticeable after heating in the steam bath for 5 minutes.

The citric acid liquor is partly separated from the precipitated calcium sulphate by decantation, and finally filtered and washed on a lead-lined Oliver filter. The

LEAD-LINED CRYSTALLIZERS IN WHICH CRUDE ACID IS FORMED

first liquor from the freshly decomposed citrate, containing 12 to 15 per cent citric acid in solution, is run direct to the open evaporators and settling tanks. The wash liquors are returned to a decomposition tank and used to suspend the next batch of citrate for treatment with H_2SO_4.

The acid liquors removed by decantation carry some suspended gypsum. All the fresh liquors are run to square, lead-lined tanks of about 17,000 liters capacity. From there the liquor is drawn into a lead-lined vacuum pan, where it is evaporated to a density of 30 deg. Bé. It is then run again into lead-lined open tanks, where the gypsum is removed by settlement. The liquor thus clarified is drawn back into the vacuum pan and concentrated to 40 deg. Bé., and run into lead-lined crystallizing pans.

The brown crystallizers (so named because crude or brown-colored crystals only are made in them) are 32x340x287 cm., with a working capacity of 2,000 liters of liquor. About 4 to 7 days is required for the complete cooling of the liquor and the crystallization of the citric acid, the time varying with the temperature of the room and the density and purity of the liquor.

When crystallization is complete, the mother liquor is drained off and the crystals are shoveled out and conveyed in small Monel-metal lined buggies to a hopper, from which it is fed into the centrifugals—standard Weston-type, bronze-basket machines, manufactured by the American Tool & Machine Co., and equipped with lead-lined curbs. The screens used are of perforated Monel metal or copper. In these centrifugals the crystals are washed well with cold water and dried. The crude acid is generally crystallized in granular or small crystals by keeping the liquor gently agitated in the crystallizing pan. The average yield from a crystallizer is 1,250 kg. of crude acid.

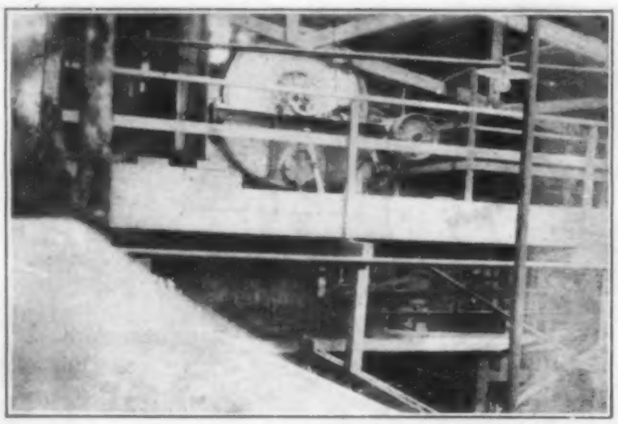
Purification of Crude Acid

The crude crystals are dissolved in water in a lead-lined tank, provided with a wooden agitator and a heating coil made of lead or copper. Here the impurities are precipitated and later removed by filtration. These include lead, copper, nickel, iron, calcium sulphate, sulphuric acid and coloring matter.

Several reagents are used. It has been found practicable and economical to apply these for the removal of the impurities in the following order:

Lead, Tin, Antimony, Copper.—These metals are precipitated as sulphides from the acid solution by treatment at about 70 deg. C. with hydrogen sulphide or barium sulphide. About 10,000 liters of liquor of 20 to 25 deg. Bé. is treated at a batch, and about an hour is required for the precipitation of the sulphides.

Iron, Nickel.—These are removed by precipitation as ferrocyanides. Calcium ferrocyanide is very soluble and reacts with the citrates of these metals to form



OLIVER FILTER HANDLING CITRATE
The hopper under the filter dumps into the decomposing tanks.

insoluble ferrocyanides of iron and nickel, and calcium citrate. The latter is in turn decomposed by the excess of H_2SO_4 present at this stage, and the citric acid is set free and calcium sulphate is precipitated.

The addition of calcium ferrocyanide must be controlled carefully; a slight excess will cause a blue precipitate of nickel and copper ferrocyanide to form in the crystallizers. Details of this method have been described by me elsewhere (*Ind. Eng. Chem.*, vol. 13, p. 554).

Coloring Matter.—This is removed by means of decolorizing carbon, which is added after the treatment with calcium ferrocyanide.

The treated batch of liquor is filtered through a wooden plate-and-frame filter press and the filtrate is drawn directly into the vacuum pan, where it is concentrated to 36 to 40 deg. Bé. During this final concentration any excess sulphuric acid present is removed by the addition of milk of lime directly into the vacuum pan. An excess of lime must be avoided, and the final liquor should contain a trace of free sulphuric acid.

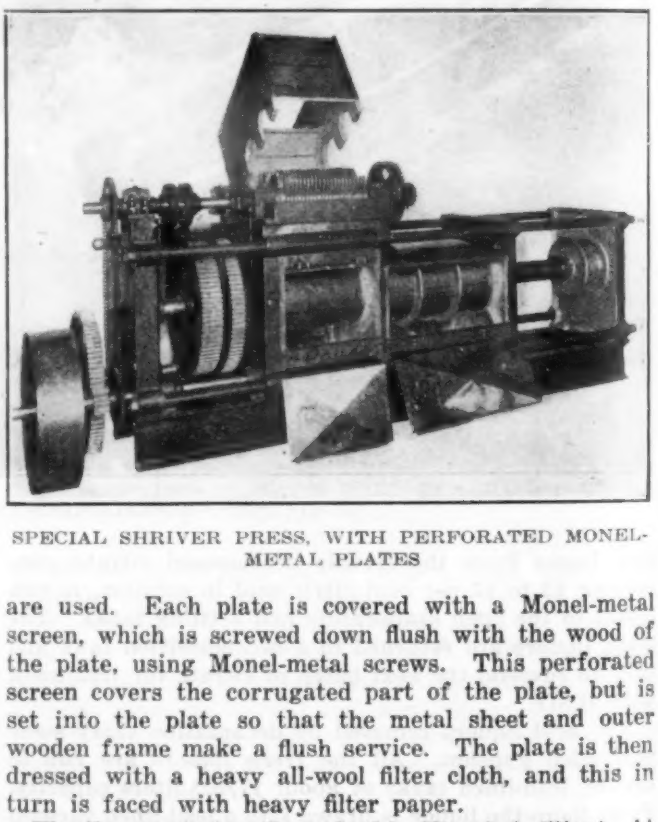
The lead-lined vacuum pans were furnished by the Oakland Copper & Brass Works, and are lined according to a patented process developed to meet this need. The pans are made of steel. The inner surface is lined with a heavy corrugated wire screen that is closely riveted to the steel shell. The wire screen and inner surface of the steel shell is tinned and the lead is then flowed on to a thickness of about $\frac{3}{8}$ in. above the wire screen. When lead is burned on copper there is always the danger of bubbles under the lead, which may cause serious loosening of the lead when under high vacuum. No such trouble has resulted with the specially constructed pans used. They have withstood several years of hard service without necessity for repair to the lining.

VACUUM PANS FOR CONCENTRATING LIQUID CITRIC ACID

When the concentration is finished, the liquor is pumped immediately through wooden plate-and-frame presses, from which it runs into the crystallizers.

Final Filtration of Pure Liquor

The final filtration is an extremely important phase of the process. The press, an 18-in. square plate and frame, with open delivery, has connections of bronze or copper tubing. Zincless bronze centrifugal pumps are used. Each plate is covered with a Monel-metal screen, which is screwed down flush with the wood of the plate, using Monel-metal screws. This perforated screen covers the corrugated part of the plate, but is set into the plate so that the metal sheet and outer wooden frame make a flush service. The plate is then dressed with a heavy all-wool filter cloth, and this in turn is faced with heavy filter paper.



SPECIAL SHRIVER PRESS, WITH PERFORATED MONEL-METAL PLATES

The liquor passing through this filter is brilliant. At times there will be unusual amounts of calcium and lead sulphates present, and the filtration will be difficult and slow. This is easily overcome by precoating the filter with carbonized Filter-Cel, made by carefully retorting the press cake obtained from the pressure filtration of lemon juice through Filter-Cel. It makes an effective filter aid for these heavy-acid liquors.

Crystallization of Pure Acid

The clear and purified liquor drops directly into the final crystallizing pans, which are of wood, lined with Monel metal. They are 130x435x20 cm. and hold about 1,150 liters of liquor apiece. When regular crystals are wanted, the pans are kept perfectly still and a crop of water-white transparent crystals is formed in from 3 to 5 days, depending on the temperature of the room. If fine or granular crystals are desired, the liquor is

kept in gentle agitation by stirring by hand with a wooden paddle at 3- to 5-hour intervals. All crystallizers are covered with muslin to exclude dust.

The crystals of both kinds are removed after the mother liquor has been drained off, then washed and dried in centrifugals. The granular crystals as delivered from the centrifugals are usually not quite dry enough to conform to the U.S.P. standard of 99.5 per cent $C_6H_8O_7.H_2O$; to remove the final traces of surface moisture, they are spread on a clean floor in a thin layer 8 to 12 cm. deep and raked over occasionally to insure uniform drying. This practice is convenient, cheap and effective, because of the prevalence of low humidities in the Corona district. If the humidity falls much below 50 per cent, the acid will begin to lose water of crystallization; if it goes above 75 or 80 per cent, water will be absorbed. The conditions at Corona, with a prevailing humidity of about 50 to 60 per cent, are usually ideal for this work.

The mother liquors from the white crystals are reboiled in the vacuum pan and another crop of crystals is taken off; usually three or four crops of U.S.P. crystals are obtained thus. The liquor is then classed as brown, and the crystals obtained from it are redissolved and the resulting liquor purified, as mentioned above. In this way no acid liquors are discarded. When white liquors become impure in consequence of the removal of U.S.P. crystals, they are treated as brown liquors. When brown liquors no longer give satisfactory crops of crude acid, they are diluted and the citric acid is re-precipitated as calcium citrate, which then goes through the regular cycle.

The finished acid is a pure product. The requirements of the U. S. Pharmacopœia are high, and a rigid laboratory control of all factory operations insures strict conformity. Much of the acid produced conforms to the Merck requirements for c.p. citric acid.

The product is marketed in three forms: Crystals, granular or small crystals, and powdered acid. The two former have been described; the latter is produced from either kind of crystals, by grinding in a Williams mill, made by the Williams Patent Crusher & Pulverizer Co. of St. Louis. Citric acid of either kind is packed in barrels holding about 100 lb. of powder or 112 lb. of crystals. The containers are lined with Arkell moisture-proof paper bags.

It should be noted that the metric system has been in use in the Exchange company's plant since 1916. With metric scales, and with tanks calibrated in liters per centimeter of depth, the regular run of labor has been employed, and no trouble has been experienced. In fact, there has been shown a distinct liking for it, and something of a feeling of pride is in evidence among the workers who have readily mastered a new system of measurement. Needless to say, the use of the metric system in the factory has greatly simplified the

MONEL-METAL CRYSTALLIZERS AND BUGGY USED FOR TRANSFERRING CRYSTALS TO HOPPER OF CENTRIFUGAL

work of the control laboratory, which was responsible for its introduction into the plant.

Economics of Citric Acid Production in California

The Exchange Lemon Products Co. is an organization of lemon growers who were affiliated originally for the co-operative marketing of fresh fruit through the California Fruit Growers Exchange. They organized the Exchange Lemon Products Co. for the purpose of getting what salvage is possible from fruit that is not suitable for the average haul of 2,500 miles to market. The capital of the company is raised by contributions, which are based on the number of boxes of lemons shipped to market by each member. The capital contribution is kept proportional to the fruit shipments of the various members by means of a revolving fund, whereby each member continually pays in so many cents per box of fruit shipped, the money so obtained being used to retire the oldest outstanding stock. The plan has the merit that it works to the satisfaction of all concerned.

The company itself makes no profit. After operating and other necessary expenses are paid for a year, or other such period as the directors may determine, the remaining income is distributed according to the tonnage and quality of the fruit contributed to the factory by each member. The capacity of the factory is about 200 tons of lemons per day, but this peak is reached only for short periods, and an annual run of 15,000 tons to 25,000 tons is about normal.

For many of the data used in this paper I am indebted to H. M. May, manager, and H. H. House, chief chemist, of the Exchange Lemon Products Co.

Painting of Oil Tanks

A large-scale test of the value of different colored paints for the reduction of evaporation losses from oil tanks will be made by the U. S. Bureau of Mines.

In the past, many oil operators, especially throughout the Eastern and Middle Western fields, have adopted white or light-colored paints for storage tanks. Tests previously made indicated that evaporation from tanks painted white averages about 1 to 1½ per cent less than from tanks painted red, and about 2½ per cent less than from tanks painted black. Tests made by the Institute of Industrial Research show that dark-colored paints absorb heat to a considerable degree, and paints presenting a highly glossy surface are less absorptive to thermal rays than those presenting a mat surface.

Experiments were conducted wherein small tanks containing benzine were painted in various colors (gloss finish) and then subjected to the rays of a power arc light for 15 minutes. Tin plating and aluminum paint gave the best results. However, neither of these finishes is practicable for outside work, as iron coated with tin corrodes rapidly, and aluminum paint soon loses its gloss and becomes flaky. The rise in temperature of the benzine in a tank painted black was 31.5 deg. F., or 140 per cent greater than the rise in a tank painted white. Although results such as obtained by these laboratory experiments could not be expected in actual practice, they indicate a decided advantage to be gained by painting storage tanks white.

Low-Temperature Carbonization of Coal in Vertical Retorts

The practicability of making low-temperature coke in the Glover-West type vertical retort has been investigated by engineers of the British Fuel Research Board. Working on a coal mixture known to give satisfactory coke at 600 deg. C. in horizontal retorts, it was determined that the vertical retort heating flue temperatures should be about 850 deg. C. near the top, falling gradually to 700 deg. C. near the bottom of the retort. Steaming of the coke was found necessary for best results, at least 4 per cent of steam being required to accomplish cooling of the coke so that it would not ignite on discharge.

Full report is made of the experimental results in the Fuel Research Board Technical Paper 7, which is obtainable for 10d., postage prepaid, from the Director of Publications, Imperial House, Kingsway, W.C. 2, London.

The general conclusions are favorable to further investigation and development of this general process. Among the important conclusions expressed in the report are the following:

"In each case the coke obtained formed a very satisfactory fuel for household purposes. Practically no differences were observable in the yields per ton of coal charged, the mean being 14.3 cwt. The tar obtained was similar in composition to ordinary low-temperature coal tar, as shown, and the yield varied from 12.7 gal. with no steam to 16.6 gal. with 20 per cent steam. The yields of ammonium sulphate were exceptionally high and appeared to be increased by increased steaming. The results, however, were somewhat irregular, and it can only be said that the approximate yields were from 18 to 28 lb. per ton of coal.

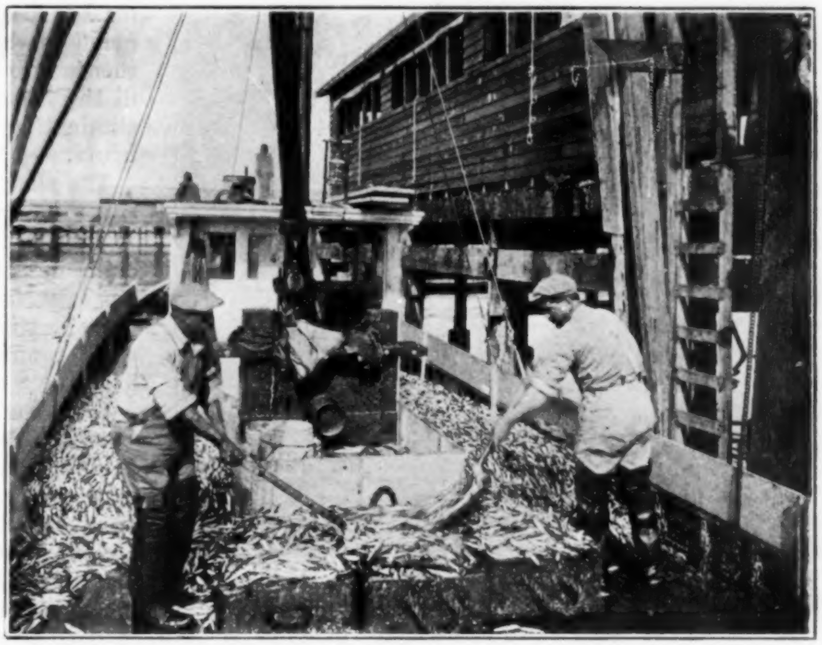
"In considering the results it must be borne in mind that the retorts used were really designed for high-temperature carbonization. With steel or iron retorts, where the rate of transference of heat to the coal would be much more rapid and in all probability a lower combustion chamber temperature could be employed, the conditions should be more favorable to good working."

Properties and Uses of Bentonite

Bentonite, when freshly exposed, varies in color from a light yellow to a light olive green, with a waxy luster, according to Joseph Keele, of the Canadian Department of Mines. It is exceedingly fine grained and has a soapy feeling when wet. In water it forms a jelly-like mass. As it is capable of absorbing water to the extent of twelve times its bulk, it forms itself into a heavy, sticky mass that renders roads almost impassable.

Although its presence in the soil is undoubtedly a drawback to transportation, bentonite has many uses, notably as a filler in the manufacture of paper and textiles, in which it has advantages over kaolin, at present largely used. Other suggested uses are: soap making, in which it can replace a portion of the soap substance; as a filler in rubber, leather, phonograph records, cordage and pressed and molded insulations; as an ingredient in gypsum and lime plasters; in ceramics; as a water softener and base for massage creams; as a carrier in printers' ink, and as a substitute for fullers earth.

A Machine and Method for
Utilizing Fish Scrap
in Making Oil and Meal



BETWEEN 30 AND 40 PER CENT OF THESE FISH NOW GO INTO VALUABLE FISH MEAL AND OIL. FORMERLY THE DISPOSAL OF THIS WASTE WAS EXPENSIVE

SCRAP is always to be found in a fish cannery. As the canning industry grows, the disposal of this waste material is becoming increasingly important. That the industry is growing, especially on the Pacific coast, is evidenced by the fact that one of the first gunboats scrapped under the international agreement is to be used for fishing purposes. The efficient utilization of scrap and of non-edible fish for fertilizer and for fish-oil production constitutes a unique problem of chemical engineering. The scrap, if allowed to accumulate, becomes not only a nuisance but an actual menace to health. For that reason it is usually imperative that some inexpensive method of disposal be resorted to. On the western coast, because of the growth of the industry, considerable interest has been aroused in the Hiller fish waste machine, which has been devised to make profitable products from the offal.

Fish oil and fish meal are commodities for which there is usually a market. The former is used to a considerable extent in the leather, paint, varnish and soap industries, salmon oil being especially adapted for use in leather dressing. The fish meal that results from drying the scrap from which the oil has been expressed is used both as a fertilizer and as a feed for livestock. These materials are the natural byproducts of the fish cannery as well as the direct product of the fishing industry itself, where fish unsuitable for food are caught on a considerable scale.

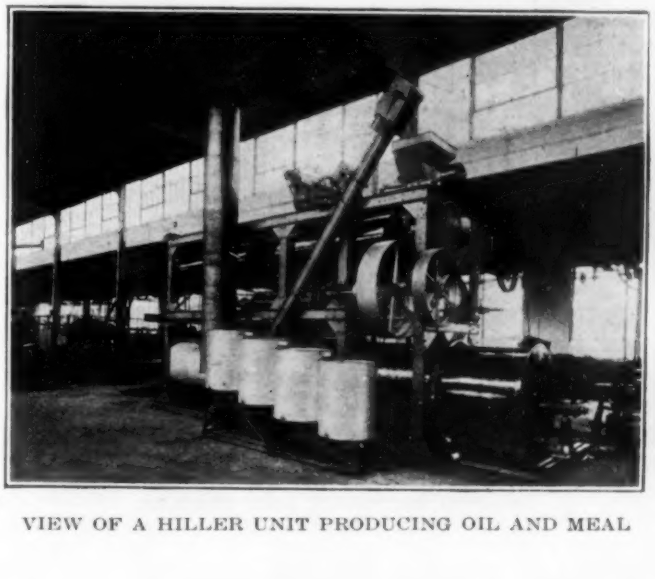
A BATTERY OF SINGLE INDEPENDENT UNITS IN PROCESS OF CONSTRUCTION

The processing of the fish waste to obtain oil and meal has been carried out by various methods in the past, usually with the evolution of especially disagreeable stenches. The method developed by Stanley Hiller is interesting in the compactness of the apparatus employed and in the apparent economies of operation. This device employs the fundamental principles of chemical engineering very effectively—disintegration in the preparation of the waste, expression in the removal of the oil, drying in the forming of the meal and further disintegration in preparing the meal for shipment. A unique feature is that the entire process takes place in a machine built as a unit, 27 ft. long, 10 ft. wide and about 15 ft. high. A further feature is the substantial elimination of the usual objectionable odors and other nuisances incident to the older methods of fishmeal manufacture. It is maintained that the new machine, when operated in the same building where foods are being prepared and packed, gives rise to no menace whatever.

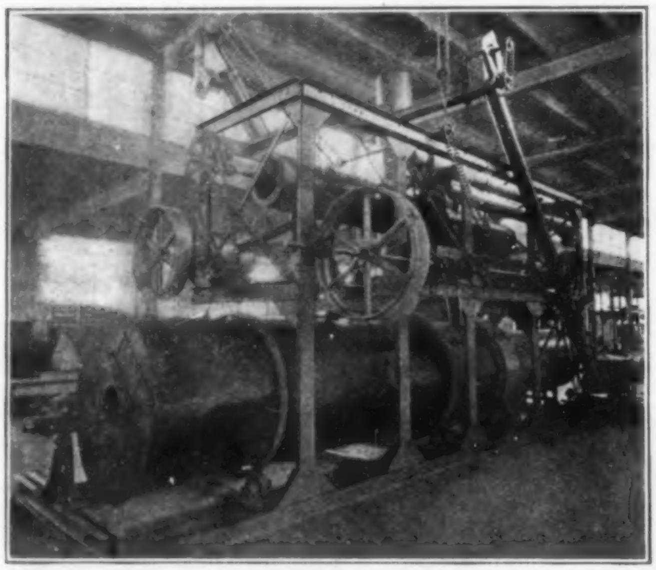
How the Process Works

The apparatus is installed as near the cutting room as possible. A conveyor connected with cutting room tables transfers the scrap fish directly into the feed hopper of the machine. The material is cut up there with a special cutter contained in the hopper. This cutter allows the use of whole fish or of fish scrap at one time, as the material is all chopped or cut to the same size, making a uniform and continuous feed.

The cut fish is next conveyed to the continuous pres-



VIEW OF A HILLER UNIT PRODUCING OIL AND MEAL



SET UP AND READY TO OPERATE—THE MAKERS CLAIM WITHOUT IMPOSSIBLE ODORS

sure cooker, where a constant pressure can be maintained, by the adjustment of the reducing valve, after it is adapted by the operator to conform to different fish. For example, herring and salmon scrap must be cooked at different temperatures. This regulation is made possible by simply adjusting the pressure at which the material is cooked.

After the material is properly cooked, it passes through the continuous screw press. This press has a number of new features—an important one being simplicity in cleaning, this being accomplished by a special device whereby the press can be thoroughly cleaned in 5 minutes time. From the screw press the course of the material, substantially oil free, is into the drier, which is of the rotary double drum type, especially adapted for this purpose running practically the full length of the machine. The primary object of this drier is to have the most intense heat, supplied by combustion of oil, come into direct contact with the meal directly from the press. This starts evaporation instantly, and as the evaporation starts, the temperature is immediately reduced below 212 deg., therefore there is no chance of burning or discoloring the meal in any way. After the meal is discharged from the drier, it is conveyed to the grinder, which can be set for any desired fineness, and thence into the hopper ready for sacking. It is possible in this way to keep a cannery in a clean condition by eliminating all storage of the fish offal for even a few hours.

SHOWING COMPACTNESS OF MACHINE—ENTIRELY LOADED ON TRUCK AND TRAILER FOR SHIPMENT

The plant when in operation works very simply. Only two men are required to operate it to capacity, providing the material (fish or fish scraps) is fed to the machine by some automatic means. One of the chief aims has been to devise a machine of sufficiently low cost to place it within the profitable range of operation for a small cannery or packer. The power consumed when handling 2 tons of scrap per hour is 15 hp.

The standard unit—as now developed—is continuous, clean and seems to be economical to operate. It handles from 3,000 to 6,000 lb. raw material per hour, depending upon the type of fish used. Costs based on actual tests, as given out by the maker, show that when installed in a plant producing 20 tons of fish waste per day, operating under fuel and power costs of the Pacific States, a net profit of close to $10 per ton of offal may be realized at present by utilizing this method of byproduct recovery. Because of the considerable flexibility of operation, the tonnage put through a given unit may be varied considerably without affecting the product.

Experimenting With Cast Lime Partition Tile

The U. S. Bureau of Standards has developed a quick-setting lime composed of 1 volume of ground quicklime and 2 volumes of hydrate. The commercial success of this material depends upon finding some way to make it keep during shipment, or else to make it into finished form at the factory. Working on this latter phase of the subject, the bureau has been developing a cast lime partition tile. Experiments have shown the best composition to be 1 volume of wood fiber, 5 of quicklime and 10 of hydrate; and that the best curing condition is outdoors, exposed to the weather. Such a block sets so that it can be removed from the mold in 10 minutes, can be handled in 20 minutes, can be sawed and nailed and has a compressive strength of 100 lb. per square inch after 7 days. It is about 20 per cent heavier than gypsum tile of the same size. Experiments are being conducted to see if the core volume can be increased without too great a sacrifice of strength.

Distillation Tests Made on Coal

A determination of the heat reactions in the distillation of coal has been made by J. D. Davis, chemist, Department of the Interior, attached to the Pittsburgh Experiment Station of the Bureau of Mines.

Distillation tests were run on various kinds of coal, wood and peat, at various temperatures. Results show that there were two critical temperatures approximately 475 and 650 deg. C. At these points is the greatest reaction speed in the primary decomposition of coal complexes. In hydrogen below 450 deg. C. in temperature reactions are mainly exothermic, whereas in inert atmospheres (N_2) they are endothermic. At 475 deg. C. it appears that the point of greatest reaction speed in the decomposition of coal is reached. Wood and peat show the same general characteristics as bituminous coal, except in this case there seems to be a more pronounced critical point of 650 deg. C.

The Gas Industry and Chemical Engineering

American Gas Association Convention and Exhibit Demonstrates Increasingly Close Relationship Between Gas Works Technology and Chemical Engineering Processes

EDITORIAL STAFF REPORT

A FEW years ago a chemical engineer attending a gas association convention would have been bored with details of gas appliances, gas-rate controversies and the problems of management, especially those of public relations of the industry. He would have found but little of a technical sort which he could profitably consider or borrow for use in other industries. But the 1923 convention and exhibit of the American Gas Association in Atlantic City, Oct. 15 to 19 was in striking contrast to the former situation. The gas industry always has been a chemical engineering industry dealing with some of the most intricate and difficult problems of chemical processing of materials. Now the industry frankly recognizes these facts and is placing increasing confidence in the chemists and engineers with chemical leanings for study and development of the essentials in gas manufacture and gas utilization.

At the Atlantic City convention great emphasis was placed upon the fundamental problems of coal carbonization, gasification of fuels through water-gas, oxygen-fired producer gas, the proper preparation of the crude gases for distribution, and efficient gas utilization in large-scale industrial equipment. In all of these lines the chemical engineering industries can profitably borrow ideas and equipment from the gas industry.

Coal Carbonization Results

To the technical men the outstanding report of the meeting was made by the committee on carbonization and complete gasification of coal, which has worked during the past year under the chairmanship of R. G. Porter. The report of the "Operators' Section" of the committee by A. C. Klein had for its purpose the compilation of statistics of coal-gas operating results. This year, as formerly, this section of the report consisted of tables of data to summarize the latest developments on a standard report basis. The committee also has continued the work on standard data sheets and standard methods of conducting carbonization plant tests. The research conducted by Professor Demorest at Ohio State University was also under this committee's supervision.

Comparison of Slack, Lump and Run-of-Mine Coal

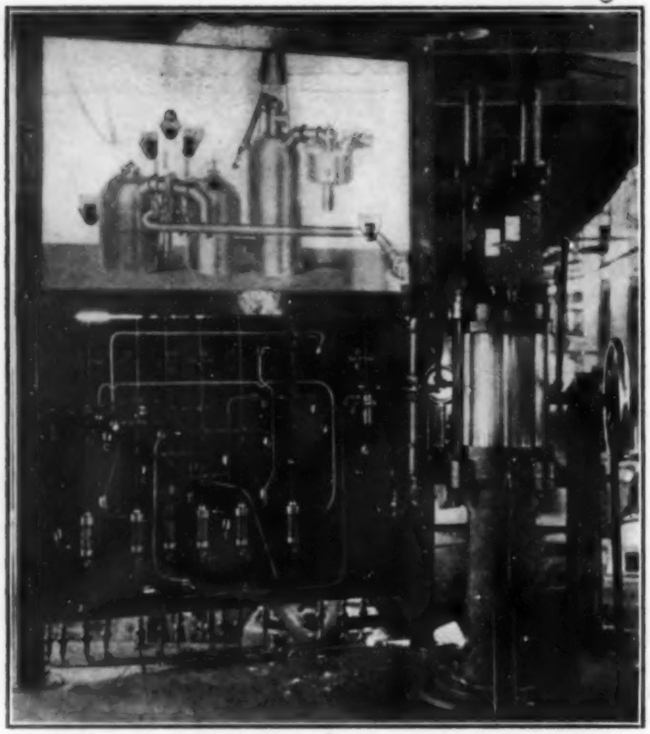
During the past year Prof. D. J. Demorest at Ohio State University has continued experimental carbonization studies in the full-size U.G.I. vertical retort, installed at the engineering experiment station of the university. This work, which has been in part financed by the A.G.A., was reported at the convention in some detail. Professor Demorest drew the conclusion from his data that screened coal is little, if any, better than run-of-mine coal or even slack coal (if fresh) on the basis of quantity of gas and total B.t.u. in the gas per pound of coal. Moreover, he concluded that the yield of coke is about the same and that there is no notable difference in the quality of the coke judged by screening or shatter tests.

The author's general conclusion was based upon a rather limited number of tests, and several of the engineers, discussing the report, disagreed altogether with the conclusion. J. H. Taussig, of the United Gas Improvement Co., pointed out that in stocking coal, lump coal has a distinct advantage and that the single retort tests described apparently do not agree with the actual operating results of a full plant, where there is found to be a distinct advantage for lump coal. Engineers of the Rochester (N. Y.) gas works pointed out that in their work the full-scale plant operations with the same type of retort as was used by Professor Demorest do not give the same conclusions. In Rochester it has been found that for every 1 per cent of run-of-mine coal used in a mixture with lump, there is a reduction of approximately 5 B.t.u. in the gas per pound of coal carbonized.

C. J. Ramsberg, of The Koppers Co., suggested the danger of using these single retort tests as an indication of large plant results, pointing out the following comparisons. The relation between Rhoda and Pittsburgh coal in the experiments is the reverse of the practical plant operating results usually obtained, both with respect to the ammonia yield and the B.t.u. in the gas. The light oil yields were only 2.5 instead of the usual 4 gal., and all ammonia yields were much lower than would be expected in practical operation. It seemed to be his, and the general, engineering opinion that Demorest's data should be used with caution as indicating the commercial value at a plant of the various sizes of coal.

Complete Gasification Prospects

Considering "complete gasification of coal" as meaning a single-stage process, the committee pointed out that there are no new processes requiring consideration this year, though processes operating more than a year ago are continuing with success, as pointed out by G. E. Whitwell. The latter had particular reference to the "back-run" process for water-gas operation which takes the bituminous coal and in a single stage carries it to



SAFETY BLOCK SYSTEM FOR AUTOMATIC WATER-GAS CONTROL

complete gasification. (See *Chem. & Met.* Oct. 8, 1923, page 664, for complete description.) This committee did point out, however, the importance of considering for the manufactured gas industry the possibilities of producer gas made with oxygen. The report on this subject is discussed below.

The back-run process was perhaps the most interesting of all water-gas developments discussed in the convention or about the exposition. Very wide interest was expressed in the strikingly successful results announced at the convention from a test on the back-run device made during July of this year by the Detroit City Gas Co. These tests were made with unscreened retort house coke, with screened retort house coke, and with screened oven coke as generator fuels. The machine capacity increased from 16 to 21 per cent; the coke consumption was decreased by 12.5 to 25 per cent; and the clinkering time was reduced by 1.25 to 1.85 hours per day. The only disadvantage noted was a small percentage decrease in oil-cracking efficiency ranging from 2.4 to 7.7 per cent. Other tests at the same plant showed, however, that at least as good oil results could be obtained with the back-run as without it, if slightly higher temperature were maintained at the bottom of the superheater and a properly designed oil spray were employed.

L. J. Willien discussed the proposed processes for complete gasification of coal, using oxygen for continuous producer work. With oxygen and steam proper temperature control is believed possible and excellent operating conditions are expected, so that this author concludes "the proposition of using oxygen in gas producers is dependent upon the ability to produce a 90 per cent oxygen cheaply." Some of the earlier data on oxygen producers had not been properly interpreted, so Mr. Willien brought together the more important figures that have been given and contrasted them in parallel columns. He pointed out that the B.t.u. of the gas made by the process would probably be between 350 and 425 per cubic foot, with a consumption of oxygen from 80 to 226 cu.ft. per 1,000 of gas made. In his opinion, only liquefaction processes can be expected to furnish oxygen cheaply enough.

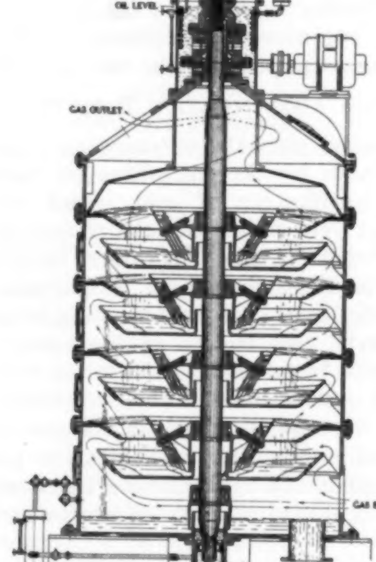
Low-Temperature Carbonization

The sub-committee on low-temperature carbonization reported very fully on the important developments in this field in the past year. Brief mention is made of each of the new processes that have received any commercial attention and some that have been dealt with only by publication. Charles V. McIntire was chairman of this sub-committee.

As a part of the work of this sub-committee, J. D. Davis, of the Bureau of Mines, reported "Some Observations on the Mixing of Coals for Carbonization." Theoretical as well as practical considerations were discussed, with particular attention to the possibility of making "synthetic coke" by adapting mixtures of poor-quality coals to work for which only high-quality coal is now employed.

The builders' section of the committee, under the chairmanship of W. E. Steinwedell, assembled again this year an excellent group of statements from each of the gas machinery construction companies. In each of these important new construction work completed or under way during the past year was summarized so that one can gain from this section of the committee's work an excellent idea of exactly what types of carbonization equipment are now being built.

The problems of water-gas equipment in connection with complete carbonization and in oxygen-fired producers have already been mentioned. Aside from these points, water-gas equipment received little attention in



TYPICAL ARRANGEMENT OF GAS SCRUBBER

the formal convention proceedings, but did arouse great interest in connection with the exhibition of water-gas control equipment. Several companies were exhibiting automatic water-gas control machines. Among these was the one shown by the Western Gas Construction Co. This concern has developed what it terms "safety block" type of control which insures that no new operating function can begin until the previous step in the operating cycle has been properly executed. Thus there is evidence with this concern and others that the labor saving inherent in automatic control must be supplemented by adequate provision for safety of operation.

Scrubbing and Purification of Gas

The report of the committee on condensing and scrubbing of gas was made by W. H. Earle, chairman. A very interesting engineering consideration of the subject is presented, but in a form that cannot be reviewed briefly here. Those in any industry having problems of gas cooling or gas washing can very profitably get copies of this report from the association headquarters.

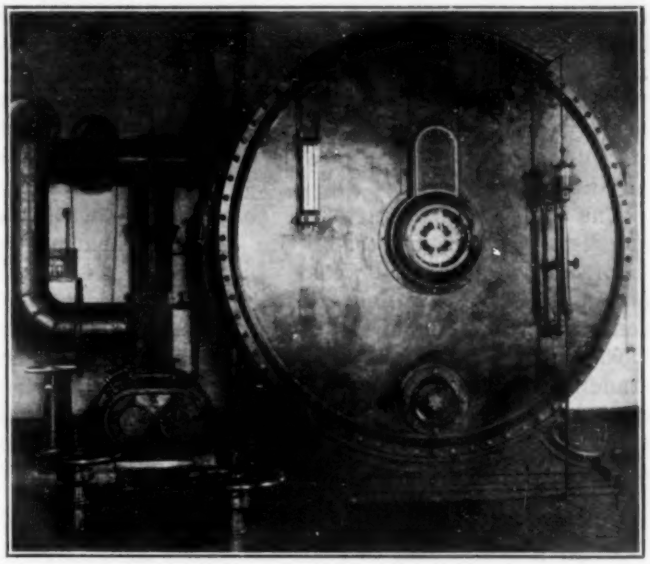
The committee on gas purification, under the chairmanship of R. W. Powell, discussed only briefly the questions of organic sulphur in gas, liquid purification, cyanogen in gas and the correlation of plant and laboratory tests. Supplemental reports by individuals brought out important data on each of these subjects. It is pointed out particularly that the organic sulphur in gas, mainly in the form of carbon bisulphide, with proper coal selection rarely exceeds the legal limit of 30 grains per 100 cu.ft. Any process designed to reduce organic sulphur in the gas, and thus indirectly permit use of lower grade coal and oil, must be so arranged as to remove the CS_2.

Progress in liquid purification of gas was discussed very fully by F. W. Sperr, who summarized all of the work up to date by The Koppers Co., which now has installed or under erection a considerable number of the liquid purification plants.

One of the most interesting points in the exhibit hall to those studying problems of gas scrubbing was the Bartlett-Hayward Co. booth, where a small unit of B-H scrubber was exhibited. The general structural relationship of this vertical, rotating tray scrubber are shown by the diagram. It, like other scrubbers of the Feld type, is recommended for its positive scrubbing action with a minimum volume of scrubbing medium.

Gas-Metering Equipment

Large-scale metering of gases has long been a problem of the gas industry, both for manufacturing control and for measurement of gas sent out from works and holder stations. There is increasing evidence at the last exhibit that the conventional types of wet station meters no longer dominate the field alone. Of course, for some time we have had meters built on the venturi principle, the Republic Meter Co. "Spitzglass" meter, the dry meters such as made by Equitable Meter Co. and Metric Metal Works and others. But increasing attention is being given now to the electric type of mass measuring meters, particularly the Thomas meter and the Connersville meter, which is in effect simply a gas compressor of refined construction. This last meter, shown first at the convention last year, appeared again with some new refinements. That it has great advantage in gas measurement where space available for equipment is limited is clearly shown by the accompanying photograph. This advantage it of course shares with some of the other newer types which do not depend upon the actual gas displacement principle.



ROTARY DISPLACEMENT METER
Capacity 100,000 cu.ft. per hour in series with drum type meter of approximately 75,000 cu.ft. capacity.

Works of the chemical committee under A. C. Fieldner can well be divided into two general parts, the one relating to co-operative tests on methods used in gas laboratories, and the other to work on gas oils. Testing of ammonia liquor and materials, testing of light oils and tars and testing of purifying oxides have all been investigated by sub-committees through analyses of identical samples at various co-operating laboratories. The results show clearly that conventional or even the so-called "standard" methods are far from satisfactory in dependability. Apparently this is in part due to inadequate description of the procedures in the literature, but also largely the result of inadequate research on exact laboratory technique.

The testing and valuation of gas oils have been considered particularly in co-operation with the A.S.T.M. As a result a tentative standard method of testing (D. 158-23T) was presented for the consideration of the gas industry.

Industrial Gas Utilization

In the whole convention there was practically no attention paid to gas lighting, for the industry is apparently convinced that industrial gas sales now demand all the development energies of the business, and lighting can be almost forgotten because of its relatively less importance. In connection with industrial gas sales, work of the industrial section of the association promises to be of great value. Engineers of this division are developing a series of handbooks that will serve as a guide for the commercial workers. Reports were made at the convention on the volumes which will discuss wholesale baking, steam boilers, house heating, large-volume water heating and such fundamental subjects as combustion. When these books are available, they promise to be of great value not alone to the industrial gas salesman but also to the industrial manager or engineer who is considering the problems of heating within his own plant. Every

chemical operation which requires heat must now be studied to determine whether gas is not now the preferred fuel. Even though one may not go all the way with the association when it says, "If it is done with heat, it can be done better with gas," yet he must admit that gas does deserve serious consideration for any heating job.

The rapid development of residence heating with gas suggests interesting possibilities of space heating in laboratories, offices and works where fuel gas is available but where steam or a coal-fired unit could not conveniently be employed. The public utility manager looks upon such heating loads primarily from the standpoint of what influence they have upon his load curves. If they add to the winter-time peaks and accentuate the summer valleys of gas sales, they are not desirable additions to the business.

Metal Melting by Gas

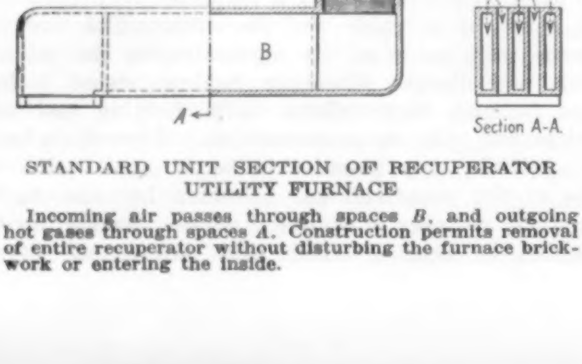
Metal melting, heat-treating and other metallurgical operations with gas are, of course, an old story, but new types of equipment for this work continue to add to the favorable prospects in this field. Small "unit" devices were shown by the Combustion Utilities Corporation as accessories to some such heating equipment. The metal-forging equipment shown on the Boardwalk front of the exhibition hall was equipped with the unit type recuperator developed by this company. It was a subject of general comment that forging temperatures could be maintained in this furnace for spectacular blacksmithing work, although the flue temperatures were maintained at a surprisingly low point. The diagrams show this recuperator unit.

Similar small-unit devices for gas heating liquids or gases were shown by this company. These unit devices lend themselves particularly to operations where frequent replacement of heating units is anticipated.

Furnace Construction and Insulation

Several concerns showed industrial furnace equipment, muffles, etc., of chemical engineering and metallurgical interest. In all cases increased attention to efficiency of the furnace is emphasized because of the continued increase in fuel costs.

The Johns-Manville Co. in its booth attracted some attention by a new type of insulating material which it calls "firebacking." This material is furnished in standard pipe-covering sizes and also in block form, of various thicknesses, from 1 to 4 in., inclusive. It is recommended for insulating very hot surfaces, where the insulation must resist temperatures up to 1,200 deg. F. Thus it promises considerable value for the



STANDARD UNIT SECTION OF RECUPERATOR UTILITY FURNACE

Incoming air passes through spaces *B*, and outgoing hot gases through spaces *A*. Construction permits removal of entire recuperator without disturbing the furnace brickwork or entering the inside.

chemical engineer in heat conservation on process equipment operated at high temperature which hitherto could be insulated only by refractories of a ceramic type. The producers claim for it a very desirable combination of "good insulating value, high-temperature resistance, mechanical strength and moderate cost."

Coal Supply and Coke Disposal

O. P. Hood, chief mechanical engineer of the Bureau of Mines, presented one of the very few addresses given by men outside of the gas industry. He discussed the question of coal supply for the gas man under the topic "The Regional Service of Coal," pointing out the intricacy of gas coal supply and urging careful analysis of the traffic problems involved. At the present time the average coal haul in Illinois, Missouri, Iowa and similar mid-Western states is approximately 150 to 175 miles. But the gas-coal used in these states has an average haul of 400 to 600 miles, largely because the gas man insists upon very stringent specifications as to quality. Though recognizing that local fuels will not always serve the gas man adequately, the speaker urged that there be less tendency to emphasize standards of gas quality which restrict the available coals to those of very highest gas-making value, in order that the service of the customer may be accomplished with locally available coal to a larger degree.

Coke-Oven Temperatures Measured

The mechanism of high-temperature coking was discussed by D. W. Wilson, of the Massachusetts Institute of Technology Buffalo Station. From temperature and pressure measurements made at various points in the coke oven, he concludes that the phenomena of high-temperature carbonization in coke ovens must be studied in three stages: (*a*) The travel of the fusion zone to within 1.5 in. of the center. (*b*) The travel of this zone to the center. (*c*) Additional heating of the now fully formed coke to give it strength and drive off the last volatile matter.

Using the record of simultaneous continuous temperature measurements during coking, the author drew isotherms showing the inward travel of the heat and derived equations from each of these which apply well for the first stage of coking—that is, up to 1.5 in. from the center. Another series of calculations developed a formula showing relation between width of oven in inches and actual coking time with any maximum flue temperature and given coal. The author regards these data and formula as preliminary in nature and urges further analysis of the physical relationships as the guide to proper coke-oven design.

Other problems of the convention dealt with all phases of public relations, accounting, new business, industrial sales, appliances and the engineering problems of distribution and utilization of gas that are peculiar to public utility service. The limits of space forbid any discussion of these topics, but those interested will do well to look to the gas engineers for ideas and advice in heating problems of any sort met in industry. And, too, chemical industry will undoubtedly find much guidance in the "public relations" experiences of the gas industry when the public problems of chemical industry seem difficult. Increasing co-operation between the gas industry and other related industries will, indeed, be of increasing value to both, especially as the present tendency for improved technology in the gas business gains added strength.

Searching Chemical Literature

Annotated List of References on Sources of Information Available to the Seeker of Data

BY ARTHUR R. CADE
Industrial Fellow, Mellon Institute of Industrial Research, Pittsburgh, Pa.

THE writer has been receiving inquiries recently from several widely different sources for a list of references such as he uses in the lecture course on chemical literature, given by him at the University of Pittsburgh. It would seem therefore that there might be others interested and for that reason it might be of value to the readers of *Chemical & Metallurgical Engineering* to have the following selected list. This list, although not necessarily complete as to every article published on this subject, nevertheless contains references to the most important and useful contributions:

Barrows, Frank E.: "Investigations of the Chemical Literature," *Chem. & Met.*, vol. 24, 1921, pp. 423-428, 477-479, 517-521.
A very valuable treatise on the general subject of chemical literature and its investigation, including a discussion of the use of library facilities and general reference works.

Cobb, Ruth: "Periodical Bibliographies and Abstracts for the Scientific and Technological Journals of the World." *National Research Council Bulletin*, No. 3 (1920).
A list of the several bibliographies, yearbooks, abstracts, etc., available for use in the various branches of the sciences. A section on chemistry is included.

Eason, A. B.: "Sources of Technical Information," *Electrician*, vol. 82 (1919), pp. 326-327.
A rather brief account of a few of the information sources available to technical workers; of particular value to the engineer.

Crane, E. J.: "The Journal Literature of Chemistry," *J. Ind. Eng. Chem.*, vol. 14 (1922), pp. 900-904.
A brief account of the history and distribution of chemical literature; a plea for exactness in writing and improved chemical nomenclature; together with a very thorough discussion of indexes, how to make and how to use them.

Escher, Paul: "Some Observations on Chemical Bibliographies," *Chemical Bulletin* (Chicago), vol. 7, (1920), pp. 43-45; 73-77.
A compilation of the books and periodicals available, including chiefly bibliographies, indexes, catalogs, abstract journals, general reference works, tables of constants and dictionaries most useful to the chemist.

Hamor, William A.: "Bibliography, the Foundation of Scientific Research," *Special Libraries*, vol. 14 (1923), pp. 17-21.
A concise general discussion of the value and scope of bibliography, more particularly of chemical bibliochresis. The writer's course in chemical literature, given at the University of Pittsburgh, is described in this paper.

Hamor, William A., and others: "Chemical Reading Courses," *J. Ind. Eng. Chem.*, vol. 12 (1920), pp. 701-705, 806-812.
A comprehensive list of text-books of chemistry with a brief evaluation of each, arranged according to the specific branch of chemistry involved.

Hibbert, Harold: "The Art of Searching Chemical Literature," *Chem. & Met.*, vol. 20 (1919), pp. 578-581.
A compact treatise giving methods for conducting searches in chemical literature, particularly from the viewpoint of the technical chemist.

McClelland, Ellwood H., and others: "Symposium on Library Service in Industrial Laboratories," *J. Ind. Eng. Chem.*, vol. 11 (1919), pp. 578-589.
A series of articles by various authors—chiefly librarians—on the subject of library service in the different industries which maintain department libraries.

Mack, Harvey F.: "Chemical Literature," *J. Ind. Eng. Chem.*, vol. 11 (1919), pp. 881-882.
A short historic account of the scientific journals which have been or are now published at Easton, Pa.

Noyes, William A.: "Chemical Publications," *J. Amer. Chem. Soc.*, vol. 42 (1920), pp. 2099-2116.
A historic review of the development of the scientific chemical periodicals leading up to those published by the American Chemical Society; the purpose and scope of these latter journals are then discussed to a considerable extent.

Patterson, Austin M., and Curran, Carleton E.: "A System of Organic Nomenclature," *J. Amer. Chem. Soc.*, vol. 39 (1917), pp. 1623-1638.
A rather thorough discussion of the nomenclature as used in the Decennial Index of *Chemical Abstracts*.

Sparks, Marion E.: "Chemical Literature and Its Use." A pamphlet of 80 pages, privately printed at Urbana, Ill. (1923), 2nd ed. Contains a series of lectures on the subject as given by the author to the third-year students in chemistry and chemical engineering at the University of Illinois. This is the best available treatise on the subject of chemical literature.

Sparks, Marion E.: "Chemical Literature and Its Use," *Science*, vol. 47 (1918), pp. 377-381.
A brief résumé of the lecture course given by Miss Sparks, referred to in reference above.

West, Clarence J., and Hull, Callie: "Manuscript Bibliographies in Chemistry and Chemical Technology," *J. Ind. Eng. Chem.*, vol. 14 (1922), pp. 1075-1077, 1148-1151. See also National Research Council *Reprint and Circular Series*, No. 36 (1922).
A list of some of the many bibliographies and selected lists of references compiled on the different subjects relating to chemistry, with information as to where the individual lists might be obtained. Further work on the compilation of this bibliography of bibliographies is being carried on by the National Research Council.

Using Gasoline for Refrigeration

That natural-gas gasoline can be used to advantage as a refrigerant is suggested by the fact that the "make" tanks and other parts of the equipment of gasoline plants frequently become coated with frost. Experiments recently conducted by the Department of the Interior at the petroleum experiment station of the Bureau of Mines, Bartlesville, Okla, confirm this assumption and indicate that volatile gasoline can be used to advantage in many refrigerating plants.

The Bureau of Mines is making a study of wax distillates in order to find out why satisfactory lubricating oils and waxes can be made easily from certain crude oils and only with difficulty from others. In the commercial distillation of crude petroleum it is customary to separate the distillates into the following groups: (*a*) Gasolines and naphthas, (*b*) kerosenes, (*c*) gas oil, and (*d*) wax distillate (consisting mostly of light lubricating oil, with small amounts of paraffin wax).

Wax distillate is separated into oil and wax by a process of chilling and filtering under pressure, followed by various refining operations. For experimental work of this character the Bureau of Mines has installed an experimental unit consisting of a refrigerating plant, cold room, wax chiller, filter press, sweating oven, etc.

In commercial wax plants ammonia is almost universally used as the refrigerating medium, but the compressor available for use in the bureau's experimental plant was built to handle natural gas containing gasoline vapor.

Serial 2510, just issued and obtainable from the Department of the Interior, Bureau of Mines, Washington, D. C., describes the results of experimental runs using gasoline as a refrigerant. The equipment as installed has proved adequate when using gasoline, and the results of the tests are published to provide data for making similar installations. These should prove useful where natural-gas gasoline is readily obtainable.

Heat Transfer

The Articles Published Herewith Have Significant Bearing on the Technology of This Unit Process and as Such Are of Interest to Production Men in the Chemical Engineering Industries

Effect of Size and Physical Properties on the Heat Absorption of Checkerbrick

An Account of Some Tests on Various Refractories Which Resulted in Establishing Facts of Use to Engineers as to the Relative Merits of Possible Refractory Materials

BY O. A. HOUGEN* AND DAVID H. EDWARDS†

THE chief purpose of brick checkerwork in any heat interchanger, such as in regenerators and hot blast stoves, is to provide a rapid absorption of heat from the hot outgoing gases and rapidly to transfer this absorbed heat to the incoming cold gases when the direction of gas flow has been reversed. It is the purpose of this paper to study some of the factors determining the rate of this heat interchange.

In the selection of refractories for the checkerwork of heat interchangers other properties besides thermal properties, such as fusion point, load-carrying capacity at high temperature, resistance to spalling, chemical corrosion and abrasion, etc., must be given primary consideration. In fact there are usually no refractories possessing all these desirable properties. In most cases the choice of a refractory must be restricted to a single type without consideration of its thermal properties.

The customary construction and design of checkerwork has been based upon years of experience. The use of standard shapes and the attainment of high mechanical strength have usually determined the type of construction.

Despite these restrictions, it was thought desirable to study those properties of a checkerbrick which determine the rate of heat absorption, inasmuch as such a study might suggest possible improvements, either in composition, construction or operation.

In order to study the process of heat interchange it will be convenient to confine our attention to one particular point in the checkerwork. In this discussion a brick located in the middle of the regenerator is chosen. Assume, also, that the regenerator is operating steadily with a constant temperature in the combustion chamber so that the average temperature gradient of the outgoing hot gases and also of the incoming air and producer gas will be the same for each cycle. When such conditions are established, the average temperature of the brick will be constant.

The transfer of heat from the hot gases to the brick will take place by the usual three ways: by radiation, by convection and by conduction. The transfer of heat by radiation can be neglected because this depends upon the emissivity of the hot gases, which is practically zero. If the gas contains suspended material such as soot and slag, its emissivity might be considerable, in which case there would be some transfer of heat by radiation. The presence of such dust is, however, accidental rather than intentional, so this factor is neglected.

Transfer of heat by convection depends upon conduction of heat through a thin film of gas adhering to the surface of the brick. The effect of a high velocity of gas is to reduce the thickness of this film of gas by a shearing action. The thickness of this film will vary inversely as the square root of the velocity (approximately), hence the heat transmission by convection will vary as the square root of the velocity. The average temperature of the surface of the brick will be lower than the average temperature of the hot gases passing by. The temperature actually measured with an optical pyrometer sighted on this brick (assuming that black body conditions prevail) will be the surface temperature and not the temperature of the hot gases. Also, if a properly protected thermocouple were inserted into the regenerator at this point, its recorded temperature would correspond more closely with the surface temperature than with the tempera-

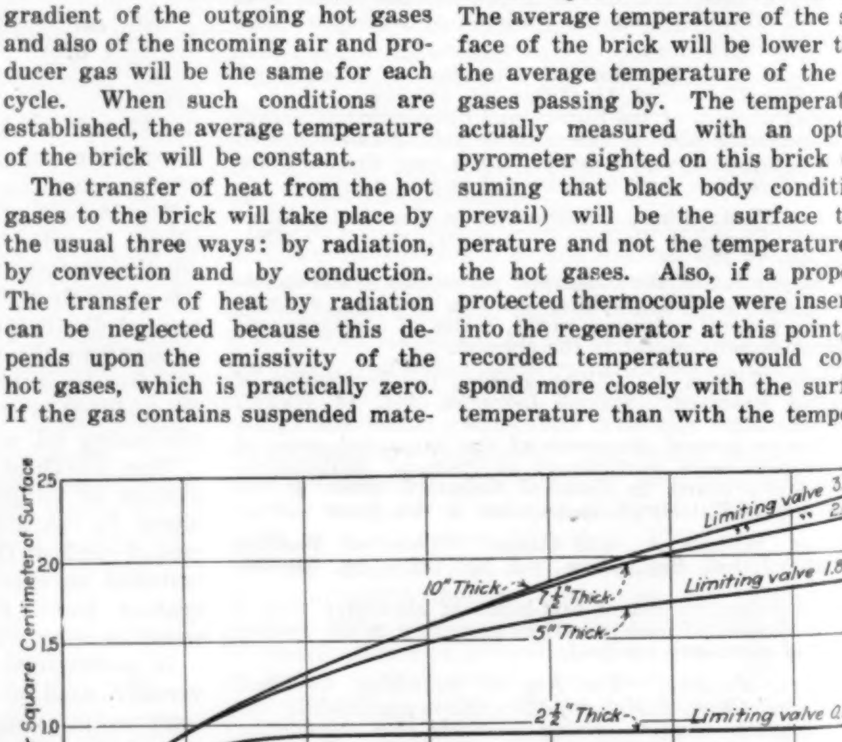


FIG. 1—CURVES OF TOTAL HEAT INFLOW INTO SILICA BRICK

*Assistant Professor Chemical Engineering, University of Wisconsin.
†Student, 1923, University of Wisconsin.

ture of the hot gases. If the temperature of the surface of the brick is measured instead of the actual temperature of the gases passing by, the temperature of the gases need not be considered.

Theory of Heat Conduction in Checkerwork

The transfer of heat from the surface of the brick to its interior will take place by conduction. The rate at which heat will be stored up in the brick will depend upon its thermal conductivity, density, diffusivity and specific heat. It will also depend upon the thickness of the brick, its shape and specific dimensions. The maximum amount of heat which the brick will absorb will depend upon the original mean temperature difference between the surface and the average initial temperature of the brick; upon its density, specific heat and volume.

The rate of heat flow through any particular area of the brick will be equal to the product of the thermal conductivity and the temperature gradient in the direction of heat flow at that point. As the brick becomes saturated, the temperature gradient at this point approaches zero and no more heat will flow or be absorbed. If, however, the checkerbrick were located on the outside wall, it would be receiving heat from only one side and losing heat from the other side. In this case the brick would never become saturated, but would assume a constant temperature gradient that would correspond to the state of steady flow when it would be losing heat as rapidly as it received it.

The mathematical relation expressing the amount of heat that is absorbed by a brick heated from two sides only when the temperature of the two surfaces is held constant is given by the equation:

$$H = \frac{-4k\theta_o p}{h^2\pi^2}\left\{\left(e^{\frac{-h^2\pi^2 t}{p^2}} - 1\right) + \frac{1}{9}\left(e^{\frac{-9h^2\pi^2 t}{p^2}} - 1\right) + \frac{1}{25}\left(e^{\frac{-25h^2\pi^2 t}{p^2}} - 1\right) + \dots\right\}$$

where H = gram calories which have flowed through 1 sq.cm. of surface area in time t.

t = time elapsed in seconds.

p = thickness of brick in centimeters.

h^2 = diffusivity $= k/c\rho$ where

k = thermal conductivity in gram calories per centimeter cube per second per degree Centigrade.

ρ = specific heat.

c = apparent density.

$\theta_o = \theta_s - \theta_b$ where

θ_s = temperature of surface of brick.

θ_b = average initial temperature of brick.

The reader must take the above equation for granted or refer to Ingersoll and Zobel's treatise on "The Mathematical Theory of Heat Conduction." The development of this equation in this paper is deemed inexpedient and unnecessary.

Theoretically the above equation holds only for the special case of parallel walls which are heated from two sides only. This approximates the condition encountered in many types of heat interchangers. With a few simple assumptions the equation can be made applicable to the more complicated checker construction as shown later.

In applying this equation to actual cases, the exponential terms after the third always drop out for values of time greater than 5 minutes, and in many cases only the first exponential term need be considered. In evaluating the expression, however, it is necessary to find the sum of the series

$$1 + \frac{1}{9} + \frac{1}{25} + \frac{1}{49} + \frac{1}{81} + \dots$$

This can be done by remembering that when $t = \infty$ the brick will be uniformly heated to the temperature θ_s. The heat capacity of a brick per degree difference will be $cp\rho A$. where A is the area of one side of the brick. The total heat that has passed into the brick through unit area from one surface is given by the following

$$H = \frac{c\rho p\theta_o}{2}$$

Substituting $t = \infty$ and equating, we obtain

$$\frac{c\rho p\theta_o}{2} = \frac{4k\theta_o p}{h^2\pi^2} \times \left(1 + \frac{1}{9} + \frac{1}{25} + \frac{1}{49} + \frac{1}{81} + \dots\right)$$

Transposing terms, and remembering that $h^2 = \frac{k}{c\rho}$ the value of the series

$$\left(1 + \frac{1}{9} + \frac{1}{25} + \frac{1}{49} + \dots\right) = \frac{\pi^2}{8} = 1.232$$

Effect of Size and Physical Properties

By application of the above formulas the effect of size and physical properties of various refractories on the rate and amount of heat absorption can be studied. It was decided to study six different bricks of widely differing properties. The bricks selected were carborundum, graphite, silica, firebrick, magnesia, and Sil-O-Cel. These bricks were selected because they represent the very widest variation in properties, though it is obvious that graphite and Sil-O-Cel would be entirely unsuitable as checkerbrick. The thicknesses chosen were 2½, 5, 7½ and 10 in. respectively, because these dimensions represent even multiples of the standard thickness, 2½ in.

The thermal properties of these refractories are not known with any high degree of precision. The best data available are tabulated in Table I. It should be noted that these properties vary with the raw materials used and the method of manufacture, particularly the temperature of firing. The thermal conductivity and diffusivity units were taken at an average temperature of 750 deg. C.

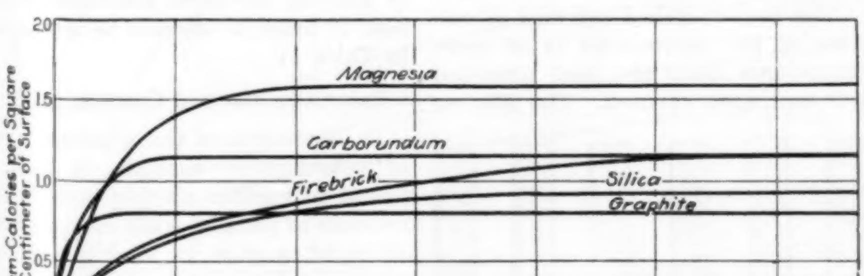


FIG. 2—HEAT ABSORBED BY VARIOUS REFRACTORIES

TABLE I—THERMAL PROPERTIES OF REFRACTORIES

Material	Apparent Density	Specific Heat	Thermal Conductivity	Diffusivity
Graphite	1.79	0.16	0.291	1.02
Carborundum	2.30	0.16	0.024	0.065
Magnesia	2.27	0.22	0.0135	0.027
Silica	1.56	0.19	0.00375	0.0227
Firebrick	1.905	0.19	0.00327	0.00903
Sil-O-Cel	0.48	0.19	0.00024	0.0026

Chemical Rubber Co.'s Handbook.
B. Dudley Jr. in *Trans.* Am. Chem. Soc., 1915.
Celite Products Co. catalog.

TABLE II—TIME REQUIRED TO HEAT REFRACTORIES OF VARIOUS THICKNESSES
(Parallel Walls—Only Two Surfaces Exposed)

Type of Brick	Thickness, In.	Heat Capacity Per Degree Per Unit Area (Gm./Cal.)	Time Required to Reach 95% Saturation, Min.
Magnesia	2½	1.59	6.9
	5	3.18	27.5
	7½	4.77	61.9
	10	6.36	110.0
Carborundum	2½	1.16	3.0
	5	2.35	12.0
	7½	3.53	27.0
	10	4.70	47.0
Silica	2½	0.934	14.5
	5	1.87	58.0
	7½	2.81	131.0
	10	3.73	233.0
Firebrick	2½	1.15	21.0
	5	2.31	64.0
	7½	3.45	188.0
	10	4.62	336.0
Graphite	2½	0.84	0.19
	5	1.68	0.74
	7½	2.98	1.67
	10	3.35	2.91
Sil-O-Cel	2½	0.298	75.0
	5	0.578	296.0
	7½	0.867	671.0
	10	1.156	1,190.0

TABLE III—MAXIMUM PERIOD OF REVERSAL FOR REFRACTORIES—2½ IN. THICK

Material	Time of Reversal of Gas, Min.	Heat Absorbed Per Sq.Cm./Cal.
Graphite	0.2	0.8
Carborundum	3.0	1.1
Magnesia	6.9	1.51
Silica	14.5	0.90
Firebrick	21.0	1.09
Sil-O-Cel	75.0	0.275

Assuming the average initial temperature of the brick as being 750 deg. C. and the surface maintained at a temperature 1 deg. higher by the hot gases passing by, the total heat absorbed at various time intervals through 1 sq.cm. of surface was calculated. These values were obtained for all six different bricks and for the four thicknesses. The results of these calculations are shown in the accompanying Figs. 1 and 2. These graphs indicate the most desirable time interval between gas reversals for checkerwork of a given material and thickness. They also indicate the best material and thickness to employ when the interval between reversals is fixed. For instance, the 2½-in. silica brick, Fig. 2, is found to have absorbed the maximum heat in 15 minutes, while the Sil-O-Cel brick of the same thickness is still absorbing heat at the end of 1 hour.

A comparison of the heat absorbed in various time intervals is also shown in Fig. 2 for a wall 2½ in. thick. These curves indicate that magnesia would make the most desirable checkerbrick. However, the disadvantage of magnesia is that it spalls so rapidly as to make it unsuitable. Carborundum is the next best material. It absorbs heat very rapidly. However, it can be seen from the curves that for a thickness of 2½ in. or less carborundum possesses no advantage over firebrick when the period of reversal exceeds 25 minutes.

From consideration of Fig. 2 it is seen that if a suitable refractory could be constructed possessing the thermal properties of magnesia, it would be an ideal material for checkerbrick. On the other hand, a material like Sil-O-Cel should be entirely avoided. High thermal conductivity, density and specific heat are all desirable in checkerbrick material.

The time required for any brick to attain a constant uniform temperature is theoretically infinite. The time required to absorb a given proportion of the maximum heat possible under given conditions can be computed. Table II shows the time required for the various bricks to absorb 95 per cent of their maximum heat. It can be shown from the equation expressing the relation between total heat and time that for any material, the time required for various thicknesses of brick to absorb a given proportion of its maximum value of heat will vary as the square of the thickness of the brick. From this law, and from the curves above, the heat absorbed for any thickness in a given time interval can be obtained at once.

Table III shows the best interval for reversal for walls 2½ in. thick.

Heat Absorbed Per Unit Volume

The heat absorbed per unit of volume of the regenerator is of more importance than the heat absorbed per unit area exposed. The heat so

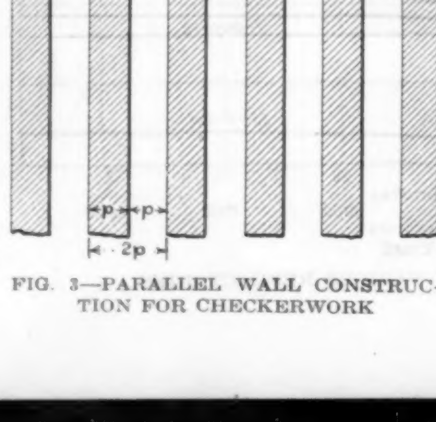


FIG. 3—PARALLEL WALL CONSTRUCTION FOR CHECKERWORK

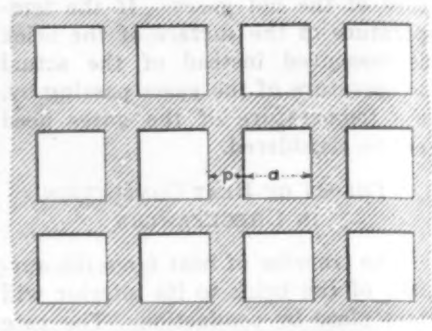


FIG. 4—REGULAR CHECKERWORK CONSTRUCTION

absorbed will vary with the type of construction. Consider first a construction made of parallel walls and assume a ratio of free space to total cross-sectional area in unity. (See Fig. 3.) This ratio corresponds very closely to the values found in practice, such as in hot blast stoves. The free area exposed per cubic meter of volume will be $10^6/p$ sq.cm., where p denotes the thickness of wall. The total heat absorbed per cubic meter per degree initial difference in temperature can then be found by multiplying the values of H obtained previously, by the factor $10^6/p$.

TABLE IV—THICKNESS OF SILICA BRICK, HEATED TO 95 PER CENT SATURATION IN VARIOUS TIME INTERVALS

Time, Minutes	Thickness of Brick, Inches
1	0.7
5	1.55
10	2.18
20	3.08
30	3.78
40	4.36
50	4.88
60	5.35

The resulting values have been plotted for silica brick of various thicknesses in Fig. 5. These curves show that for a given time interval the heat absorbed per unit volume increases with decreased thickness of the material up to the limit of saturation. With a given time interval of heating, the most desirable thickness of brick to use will be as shown in Table IV.

Regular Checker Construction

In regenerators the common type of construction consists of bricks placed in regular checker style with two sets of parallel walls intersection at right angles to each other as shown in Fig. 4. In treating this case it is assumed, as before, that the free cross-sectional area is equal to the cross-sectional area of the brick. The exposed area per unit volume will be less than for parallel walls. On the other hand, the average heat flow per unit area will be

slightly greater, because in this case part of the heat flow is radial. The exact analysis of this case is extremely difficult, but a close approximation can be arrived at by assuming that the average rate of flow for parallel walls multiplied by a factor which is the ratio of the shape factor of the second case to the shape factor of the first case per unit area. The shape factor for the checkerwork for one square opening, 1 cm. long, is given by the formula (Langmuir, *Trans.* Am. Electrochem. Society, 1913, vol. 24, p. 53),

$$S = \frac{A}{p/2} + 0.54\ \Sigma l.$$

Where
A = area;
p = thickness of wall;
m = length of channel;
Σl = the sum of all corner edges.

From Fig. 4 it will be seen that the following relations exist where p = thickness of wall and d = width of opening:

$$2d^2 = (p + d)^2;$$
$$\sqrt{2} \times d = p + d;$$
$$p = 0.434d;$$
$$A = 4dl = \frac{4pl}{0.434}$$
$$S = \frac{\frac{4pl}{0.434}}{\frac{p}{2}} + 0.54\ (4l) = 20.56l.$$

The shape factor for parallel walls for the same area and thickness of wall is given as

$$\frac{A}{p/2} = \frac{\frac{4pl}{0.434}}{p/2} = \frac{8l}{0.434} = 18.4l.$$

Hence the ratio of shape factor is

$$\frac{20.56}{18.4} = 1.12.$$

This ratio indicates that the heat flow per unit area is 12 per cent greater in checkerwork than in parallel wall construction when the thickness of wall and free cross-section are the same in both cases.

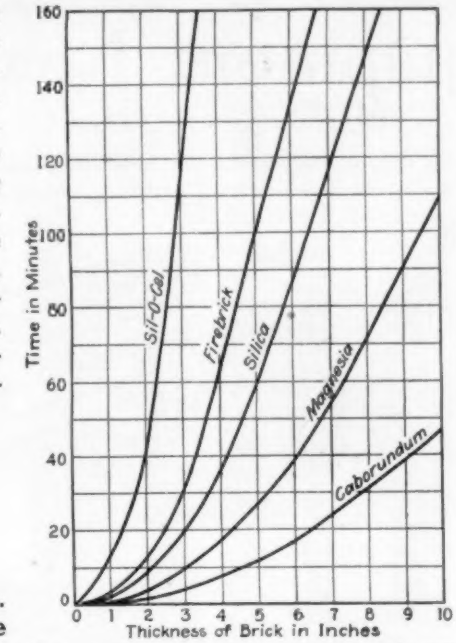


FIG. 5—TIME REQUIRED TO HEAT REFRACTORIES LONGEST DESIRABLE PERIOD OF REVERSAL

The ratio of the area exposed per cubic volume in the two cases will be found as follows:

First consider parallel wall construction. The number of walls per square meter of cross-section is $\frac{100}{2p}$

The area exposed per cubic meter is then

$$\left(\frac{2 \times 100}{2p}\right) \times 100^3 = \frac{10^6}{p}$$

The area exposed per cubic meter for checker construction is given by the formula

$$\left(\frac{100}{d + p}\right)^2 (100) 4d = \frac{0.868 \times 10^6}{p}$$

Hence the ratio of areas exposed by checkerwork and parallel wall construction is 0.868.

Combining these two ratios, we find that the ratio of heat transfer per cubic meter of regular checker to parallel wall construction is $1.12 \times 0.868 = 0.972$.

This indicates that the rate of heat flow into regular checkerwork per unit volume is 3 per cent less than for parallel wall construction. The time required for a given heat flow is accordingly 3 per cent greater for regular checkerwork than for parallel walls of the same thickness.

It should be remembered that the values given hold strictly only when the average temperature of the refractory is 750 deg. C. When the average temperature exceeds this value, the rate of heat absorption is slightly greater, whereas for lower temperatures the rate is slightly less. The amount of variation from the given values depends upon the variation in the thermal properties of the refractory material with temperature.

Grateful acknowledgment is extended to Prof. L. R. Ingersoll for his kindly criticism of this paper and for the inspiration of his instruction.

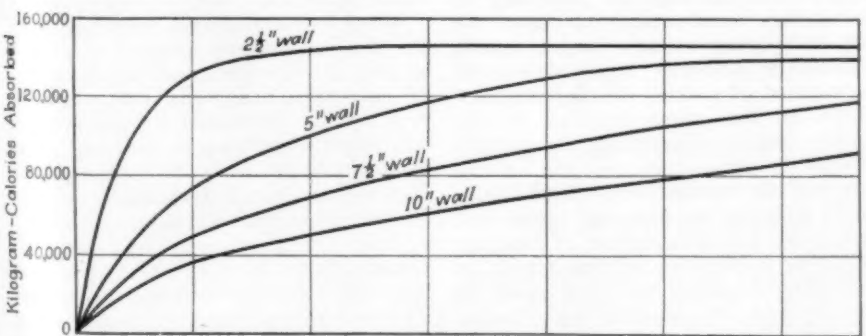


FIG. 6—TOTAL HEAT ABSORBED PER CU.M. OF CHECKERWORK. SILICA BRICK. PARALLEL WALL CONSTRUCTION. AVERAGE TEMPERATURE 750 DEG. C. FOR REGULAR CHECKER CONSTRUCTION ADD 3 PER CENT TO TIME INDICATED

Insulation of Periodic Kilns

Proper kiln insulation not only results in greatly reduced burning costs but brings about other advantages. According to the facts presented before the American Ceramic Society by J. H. Krusen, a much more uniform distribution of heat is thus made possible, which eliminates the necessity of forcing the fires and overheating the hotter portions of the kiln in bringing the cooler parts up to the desired temperature. The outer walls are protected against rapid temperature changes, reducing the danger of cracks developing with resultant air infiltration.

As is generally known, heat may be transmitted in three ways—namely, by conduction, radiation and convection. Of these, conduction plays the most important part in connection with kiln design and the amount of heat which will be conducted can be reduced or practically eliminated by installing, as a component of the wall, a layer of material having a relatively low conductivity and high thermal resistance.

At least 25 per cent of the heat generated in burning a kiln is lost by conduction through and radiation from the brickwork, and a considerable amount used in heating the large volume of brick in the side walls, crown, flues and the earth on which the kiln is built. On the average yard the fuel loss sustained in this way is more than 25 per cent.

Equipment News

From Maker and User

Radiant Heat Furnace

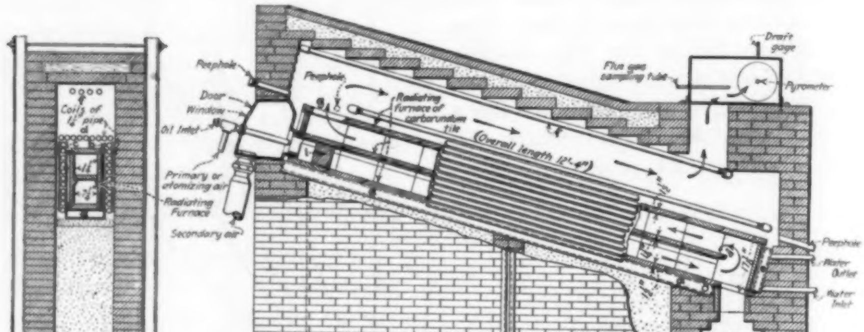
A new type of furnace for use with boilers and other types of heat equipment, called the Cannon Radiating Furnace, and made by the Carborundum Company, Refractory Division, Perth Amboy, N. J., has recently been placed on the market. It is claimed that this new furnace, instead of depending largely on convection for its heat transfer, transmits from 80 to 100 per cent of the total heat transferred by radiation from the outside of the combustion chamber.

Combustion of the fuel used, whether it be gas, liquid fuel or powdered fuel, is accomplished in a two-pass combustion chamber or "radiation flue" of rectangular section and twice the length of the furnace. The walls of this chamber are of carborundum refractory tiles. These tiles are rendered incandescent by the heat and, in accordance with the well-known properties of carborundum, the heat is then readily transmitted through the tiles and radiated from their outside surfaces.

When this type of furnace is used with a boiler, as shown in the illustration, which depicts the unit built at Massachusetts Institute of Technology for test purposes, the heat which remains in the gases after passing through the radiation flue is largely recovered by passing the flue gases through an economizer. This cannot be done when the furnace is used for other purposes, but the maximum amount of heat can be absorbed in the tiles by a more specialized construction.

The illustration of the test furnace does not show the exact commercial application of the furnace, as the outer brick setting here shown need not be employed. The furnace essentially consists of a long, double flue constructed of especially molded carborundum tiles. These are laid with overlapping and interlocking joints—no cement is used. The oil burner is shown at the left end of the lower flue. This could be replaced by a gas burner or powdered coal burner. The wedge block *i* in front of the burner is to facilitate ignition and mixing.

The burning gases travel in the direction of the arrows through the long narrow flue, emerging at *g*. In this passage they are close to the incandescent walls and the air and fuel are continually mixed so that complete combustion is obtained with only about 3 per cent excess air. Water-heating surfaces are placed on all sides of the flue at *a*, *b*, *c*, *d* and *e* and the economizer for utilizing heat in the waste gas is shown at *f*.



SECTIONAL SIDE ELEVATION AND END VIEW OF TEST "RADIANT FURNACE" SET UP AT M.I.T.

In the test carried on at M.I.T. the total radiating surface showed approximately 19,500 B.t.u. radiated per square foot per hour. The temperature of the exit gases at *g* was about 1,270 deg. F. Tests made with oil were at an average rate of combustion of 275,000 B.t.u. per cubic foot per hour. Tests with powdered coal were at combustion rates of 250,000 B.t.u. per cubic foot per hour with a flue gas showing 14 per cent CO_2, 4.5 per cent O_2 and no CO.

Recent Developments in Flameless Combustion

By Eric Sinkinson, B.Sc., D.I.C.
Assistant Professor of Chemistry, Lehigh University

The development of what Prof. W. A. Bone, the inventor, called "flameless incandescent surface combustion" was brought to a point of practical application in 1909 with the "diaphragm" and "incandescent bed" types of heating. Since that day Professor Bone and other inventors have made further developments of surface combustion, until in this country it is successfully used in large-scale industrial furnaces and has received commendation from the U. S. Bureau of Standards, where, in stringent tests, temperatures as high as 1,675 deg. C. in surface combustion furnaces for laboratory purposes have been obtained.

Recently, however, improvements in the method of making "radiophragms," which is the name applied to the modern form of diaphragm, for surface combustion appliances, and the success obtained in using them industrially would indicate an extended scope and usefulness for this system of heating. It is now possible to announce that an important advance has been made in the method of constructing "radiophragms" for the application of surface combustion heating. The improvement is mainly due to F. J. Cox, who, in conjunction with Professor Bone, has undertaken a further development of this branch of the enterprise.

As early as 1909, the so-called "diaphragm" process of burning a homogeneous mixture of gas and air in the right proportions for complete combustion was evolved. By this method the combustible gas and air, fed to a chamber behind the diaphragm, would burn without flame at the exposed surface and keep it in a state of redhot incandescence, thus developing a high degree of radiant energy.

The diaphragm was made of granules of firebrick bound together into a porous and coherent slab by the addition of a small quantity of suitable cement, and the porosity was graded to suit the kind of gas to be used. The diaphragm was mounted in a case in such a way that the space behind the diaphragm and the back of the case constituted a feeding chamber for the gaseous mixture which was introduced centrally to the case.

When the diaphragm was radiating, the combustion was confined to a layer no deeper than ⅛ in., and the remainder of the apparatus was comparatively cool. This constituted a most efficient method of developing radiant heat. The combustion was instantaneous and perfect and the ratio of radiating surface to the combustion depth was high.

A new "radiophragm" has now been produced on the lines of the old one, but with certain radical differences. By improved methods of construction, the new radiophragm has not only lost some of the defects of the old ones but also has been found to give new advantages not anticipated.

Experience has shown that in constructing the "radiophragm" the granules comprising it should have perfect regularity of texture and porosity, and

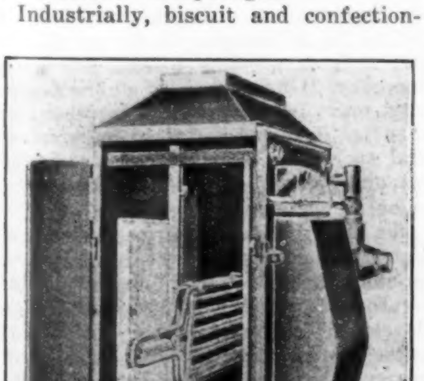
in addition a certain graduation from back to front, regulated according to the composition and pressure of the gas to be used. The result is that "radiophragms" can now be made in quantity with precision and with such uniform texture as to obviate the possibility of a creep-back of the combustion, so that back-firing cannot occur, however much the radiation from the incandescent surface may be impeded.

These "radiophragms" have withstood the severest tests satisfactorily. In one case the surface was raised to such an intense heat as to flux the surface layer of the diaphragm, yet without any signs of back-firing. This makes it possible for two diaphragms to be placed with their radiating surfaces facing each other—a very severe condition—and they continue to function properly, however long they are left. Herein lie important applications for grilling, toasting and cooking purposes. As a proof of their value in this respect alone, numerous large restaurants have "radiophragm" installations which are so successful that repeat orders are being made.

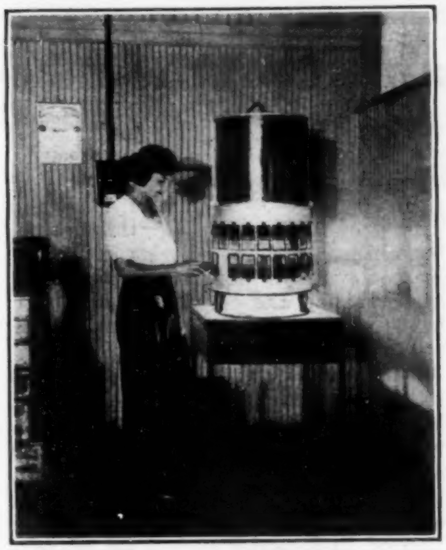
The illustration herewith shows a small griller fitted with two "radiophragms," each 20x8 in., working opposite each other at a distance of 8 in. apart. The meat is placed in a sliding support between the two "radiophragms," so that grilling takes place on both sides at once. An appliance of this kind can grill 120 steaks or chops an hour, with a gas consumption of 80 cu.ft. per hour. The gaseous mixture supplied to each pair of diaphragms is under separate control.

A jack roasting installation has now been installed at a hotel in the Midlands, so that roast beef can be cooked in the true Old English style, and this is made possible by the use of suitably constructed "radiophragms."

Industrially, biscuit and confectionery factories are employing automatic machinery fitted with gas-fired "radiophragms"; also they are on trial in connection with lead-melting, type-founding and hardening or tempering metals.



SMALL "RADIOPHRAGM" HEATING UNIT



DYE AND COLOR FASTNESS TESTER

The improvement in this branch of surface combustion work has given a new impetus to its application all around, and already cylindrical porous refractory surfaces, constructed in the same satisfactory way, are being made as "radiants" for boiler tubes to replace the magnesia fragments formerly used. By means of these cylindrical radiants maximum radiation is obtained in the tubes of the boiler, and some of the disadvantages found in the employment of other kinds of surfaces have been obviated. This means that a steam boiler with a proved efficiency 20 per cent higher than a Lancashire type of boiler has been equipped to burn combustible gas without flame, using only the theoretical amount of air necessary for its combustion with no lighting-back, so that the energy of the combustion is transmitted to the water in the boiler, almost wholly as radiant energy.

It is expected that these recent developments in the construction and manufacture of "radiophragm" appliances will lead to a rapid advance in the use of the surface combustion system of heating in both domestic and industrial fields.

Device for Testing Fastness of Colors and Dyestuffs

A Chicago manufacturer has perfected a machine for testing the fastness to light of colors and dyestuffs. This machine involves an electric arc which is controlled and maintained constant by automatic mechanisms contained within the instrument cabinet. The arc plays between special electrodes and develops a spectrum containing the ultra violet and other rays found in the spectrum of sunlight.

The cabinet surrounds the arc and incloses all of the controlling mechanism. It has a series of forty exposure openings equally spaced from the arc at a distance based upon a calculation of relative sun and arc light values and distances. The samples to be tested are placed in individual holders which are fastened before the cabinet openings. The holders are arranged to take samples up to 3x5 in., and to cover a portion of the sample so that comparison may be made between tested and untested portions. The cabinet is made in two sections, the lower of which can be raised for access to interior.

The device is made by the Atlas Electric Devices Co., Inc., 360 West Superior St., Chicago.

Self-Contained Refrigerating Unit

The demand for small-size refrigeration equipment for plants requiring only a limited amount of low-temperature capacity is daily growing. As a result a number of small refrigerating units have lately appeared on the market. The latest of these to attract attention is the CP Self-Contained Refrigerating System manufactured by the Creamery Package Manufacturing Co., 61 West Kinzie St., Chicago.

This equipment is built in $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1 and $1\frac{1}{2}$ ton capacities. The compressor is of the two-cylinder inclosed type and uses ammonia as the refrigerant. The prime mover for the smallest size is a $\frac{1}{2}$-hp. 1,200 r.p.m. electric motor which may be connected to any lighting circuit. Larger sizes have larger motors and should be connected to a power line. The condenser and receiver are inclosed and the whole equipment is built as a unit so that it may be set up wherever desired without the necessity of providing a special foundation.

Catalogs Received

THE ELYRIA ENAMELED PRODUCTS Co., Elyria, Ohio—Catalog 31. A new edition of this concern's general catalog on glass-enameled steel and cast-iron equipment for chemical and allied industries.

THE CONNERSVILLE BLOWER Co., Connersville, Ind.—Bulletin 4-A. A new bulletin containing illustrations of and information concerning the Connersville rotary displacement meter for gas plants and general chemical industrial service. Bulletin 18-C —A bulletin describing the use of Connersville blowers and pumps in connection with refrigerating systems.

WRIGHT-AUSTIN Co., Detroit, Mich.—Catalog 300. A catalog describing the Wright-Austin line of steam separators and exhaust heads. Bulletin 500—A booklet entitled "Wright-Austin Boiler Trimmings," which describes safety alarm water columns and various other boiler accessories which this concern manufactures.

HAUCK MANUFACTURING Co., Brooklyn, N. Y.—Bulletin 506. A bulletin describing the new Hauck Venturi Low-Pressure Oil Burner and giving sizes, capacities and uses.

SOUTH MANCHURIA RAILWAY Co., Dairen, China—A book entitled "Manchuria, Land of Opportunities," which is a handbook of the resources, industry, transportation and trade of Manchuria, well illustrated and written in a manner to be of much service to those seeking opportunities in that part of the world.

RELIANCE ELECTRIC & ENGINEERING Co., Cleveland, O.—Bulletin 2014, Fourth Edition. A catalog describing the type "T" heavy duty direct-current motors which this company makes.

Readers' Views and Comments

An Open Forum for Subscribers

The editors invite discussion of articles and editorials or other topics of interest

Uses for Off-Peak Power?

To the Editor of Chem. & Met.:

SIR—A very important central station in Belgium, wishing to dispose of 5,000 to 10,000 kw. of off-peak power during an 8-hour night shift, has requested me to find employment for this intermittent surplus power. An editorial in your last issue, which reached me today (Oct. 3), makes me feel that you might be willing to place my problem before your readers. I shall be very glad to receive any suggestions they may be kind enough to offer.

It seems to me that the difficulty in finding uses for such power is sufficiently great and of such general interest as to warrant thorough discussion.

IVAR J. MOLTKEHANSEN,
Ingénieur.

15, Rue Brédérode,
Brussels, Belgium.

Silica Contamination of Thermocouples

To the Editor of Chem. & Met.:

SIR—Everyone who in his daily work has to depend on accurate readings of hundreds of thermocouples will unreservedly welcome the most interesting article by O. A. Hougen and B. L. Miller, "How Silica Protection Tubes Cause Contamination of Thermocouples," *Chem. & Met.*, vol. 29, pp. 662-663. This gives some valuable data regarding changes in emf. of couples after prolonged use under different conditions, but lack of sufficiently numerous details illustrating the phenomena occurring is likely to cause misinterpretation of the authors' conclusions and to plant a seed of doubt in the mind of the reader.

One is somewhat startled by the statement that the changes in emf. are due to siliconization and is in doubt how to understand this expression. If it means that silicides of Pt and Pt-Rh alloy are formed, certain discrepancies with generally accepted views regarding reducibility of SiO_2 are called to one's attention. All attempts to produce Si by direct reduction with carbon repeatedly failed at low temperatures and resulted in formation of carborundum when an electric arc was used. In the paper referred to above an assumption is made that not only at the maximum temperature of the experiments, 1,200 deg. C., but even at lower temperatures reduction takes place, silicon is vaporized (its melting point is 1,420 deg. C.) and vapor concentration is sufficient to cause its combination with such a comparatively inert substance as platinum.

In the possession of the authors there are undoubtedly analyses or micrographs illuminating this point, but without them regeneration of emf. by noble metals and the impossibility of correcting the deficiency by proper heat-treatment of chromel-alumel couple still seems to be veiled with mystery. Assuming that silicon was reduced from its oxide by carbon monoxide at the low temperature of the experiments, we have to deal with an equilibrium of two solid phases Pt and Si and gaseous silicon at a very low pressure, and the question arises whether formation of Pt_2Si under such a set of conditions is possible.

Two hypotheses may be advanced to explain the influence of oxidizing heating on recovery of emf. It can be thought that the partial pressure of silicon vapor at the temperature to which the couple is heated during the recovering operation is not sufficient to maintain the equilibrium and silicon distills off, or that desiliconization takes place similar to surface decarbonization of steels. Lack of accurate data covering the relation between temperature and vapor pressure of silicon prevents any definite conclusions regarding the first theory. To prove the second hypothesis a statement is needed whether after oxidizing treatment the couples remained brittle. If so, it is easy to see that if all silicon in the wire, admitting that hot platinum is porous to oxygen, is converted into SiO_2 there is no means for its removal, and grains of pure platinum enveloped by brittle network of silica form a wire which is likely to break like glass.

From the other point of view, it was stated in the paper that at higher temperatures silica tubes are quite porous to gases, especially above 900 deg. C. when transformation of vitreous silica into crystalline trydimite, which began at 800 deg. C., is well under way. A conclusion that the inside of the tubes was filled with CO and CO_2 surrounding them in the experiments is not difficult to reach. The presence of a strong carbonizer like CO in a comparatively strong concentration directs one's mind to the possibility that, instead of siliconizing, formation of carbides was taking place. This helps to explain the effect of oxidizing heating on recovery of emf. by noble metals. Carbon dioxide formed from decomposition of platinum carbide easily escapes, and grains of platinum are welded together, resulting in a wire of pure metal. Base metals cannot be freed from their carbides, because, at the temperatures necessary for decomposition of the latter, affinity of the wires toward oxygen is too marked and they are subjected to danger of burning.

It seems that a series of similar tests conducted under identical conditions but using different protecting tubes will permit deduction independently from the idea on which the paper is based, contamination of couples with silicon, and results published with more complete data will be an important contribution to the science.

JOHN D. GAT, M. E.

United Alloy Steel Corp.,
Canton, Ohio.

Petroleum as a Chemical Raw Material

To the Editor of Chem. & Met.:

SIR—I read with considerable interest Dr. B. T. Brooks' remarks in your issue of Oct. 15, 1923, entitled "Petroleum as a Chemical Raw Material," and with your permission I am adding some observations of my own on the subject.

One must agree with Dr. Brooks when he states that the development of the petroleum industry to date has resulted from the application of principles almost entirely physical and not chemical. It can scarcely be called a chemical industry. The operations are principally those of fractionation, condensation and filtration, with the exception of the "cracking" art, which is a development of the last decade, and the treating of products with acid and alkali.

Although sulphuric acid has been used since the inception of petroleum refining, we know very little about the chemical reactions that take place in the operation. Also the chemistry of "cracking" has lagged way behind the practical work on the stills. This industry is in full sway and growing by leaps and bounds, representing an investment of hundreds of millions of dollars, yet a comprehensive treatise on the chemical changes that occur is yet to be published. However, this is not a fault peculiar to the petroleum industry. Under press of public necessity many developments in other industries have proceeded to huge financial successes, to be followed later by an understanding of the chemistry or scientific principles involved.

To date practically all the petroleum industry's efforts have been devoted to production of fuel and lubricants. No byproduct industry of importance has developed to provide other outlets for petroleum products, and this can scarcely happen until a large number of qualified chemists, principally organic, devote their time to the subject with this end in view. It will probably be agreed that there are enough hydrocarbons in petroleum to form a starting point for many adventures in research, but the industry has not done much in isolating these original substances. Work on this subject in this country can almost be said to have started and stopped with Mabery's researches.

Developments in the industry go ahead in a highly creditable manner indeed on those problems of pressing

moment, like "cracking," treating emulsions, centrifuging lubricating stock, increasing the yield of gasoline from natural gas, improving testing methods, improving fractionating columns, condensers, combustion, etc., but not much real research work takes place along lines to produce other substances from petroleum. It is doubtful, as Dr. Brooks states, if this can be done in the petroleum laboratories of the country as they are now constituted, although there is every excuse for the larger of the oil companies to make the attempt. Such laboratories as those of the General Electric Co. and the General Motors Research Corporation should do work equally well for the petroleum industry, granting that there are other Whitneys, Coolidges, Langmuirs, Ketterings and Midgleys in the country.

But for a long time to come the executives of the oil industry can see substantial profits ahead from producing more and better gasoline, lubricants, fuel oil, etc. With all the attendant watchfulness and funds apparently needed to provide the products and markets, it is questionable whether many will be found willing to finance research on the scale necessary to attack petroleum from other standpoints. They probably estimate that there will be such a demand for petroleum products for cutomary uses in the near future as to provide much more profit than by the establishment of new industries to produce new markets.

The writer has limitless confidence in a large group of competent technologists working with enthusiasm on any problem with ample funds and facilities at their disposal. He had a splendid opportunity to see them in action during the war under such circumstances. Problems finally yield to their assault. If the oil industry cares to look farther ahead than gasoline and lubricants, with the end in view of developing other products from petroleum, and cares to finance the program adequately and will wait a reasonable length of time for the results, technologists can be found to do the work.

Dr. Brooks states that in many refineries the chemist has very little to say regarding the operation of the plant. This is true, but frequently so because the chemical work has developed into testing routine, not research work. Very few corporations, oil or otherwise, make their chemical departments a lucrative and attractive place for competent and ambitious men to remain an indefinite length of time. Until this is done the chemical departments of corporations will not reach their widest fields of usefulness. The refinery chemist usually devotes his energies toward an operating or executive position because these are the responsible and good paying ones. Here the engineer has the advantage because he starts in the plant and is more accustomed to handling things on a large scale.

G. A. BURRELL,
Chemical Engineer.
Pittsburgh, Pa.

Review of Recent Patents

Distillation

Purification of High Melting-Point Materials by Fractional Distillation Involves the Danger of Freeze-Ups, a Problem Which Has Developed Interesting Solutions

ASIDE from the old sublimation method, the best and most economical way of refining camphor has consisted in distilling the camphor, with or without the addition of purifying materials, and receiving the camphor in a condensation chamber in the form of flowers; but this distillation process, as carried out at present by the various refiners, presents a large number of imperfections and difficulties which seriously detract from it, as is evident from the following considerations:

Crude camphor, natural or synthetic, contains the following impurities: water, light terpenes distilling below but close to the boiling point of camphor, high terpenes distilling above but close to the boiling point of camphor, and terpenic acid esters decomposable by the heat during distillation, liberating high terpenes. For example, crude synthetic camphor may contain: water, camphor m.p. 175 deg. C., b.p. 205.5 deg. C.; dipentene, liquid, b.p. 178 deg. C.; foreign terpenes, liquid, b.p. 198 deg. C.; terpenic acid ester, m.p. about 100 deg. C. b.p. 220-240 deg. C. (decomposed); colophene, liquid, b.p. 320 deg. C. Thus, when impure champhor is distilled there is, since the physical natures of the volatile constituents are so similar, a considerable entrainment of one constituent with another, making it extremely difficult to separate the various terpenes in an efficient manner; the dipentenes, foreign terpenes and colophene will pass with the camphor, and the terpenic acid ester, which decomposes at 240 deg. C., will pass along in small proportions but in sufficient amount to cause a serious contamination of the distillate, as it is yellow in color and will decompose later on when the camphor is used in plastic making. Yet, because of the difficulty of handling the camphor, due to the small difference in temperature between its melting and boiling points and to the facility with which camphor solidifies when cooled for but a short time, camphor refiners have confined themselves to the simplest apparatus, consisting merely of a still, a vapor pipe and a sublimation chamber, although recognizing that such a procedure could not give the desired purity. Fear has always been expressed that a less elementary process would be unworkable due to freezing up of the system.

Recently, however, Ronald L. Andreau has developed a method of fractional distillation in which the danger of freeze-ups is eliminated. Operation with camphor containing the impurities noted above may be outlined as follows, use being made of an apparatus comprising a still, reflux bubbler-plate fractionating column having a reflux pipe to the still and having provisions for heating the liquid on the plates, a dephlegmator connected with the column by a reflux pipe, and a condenser, all arranged in series: First, the water is driven off and the steam conveniently bypassed so as to not pass through the column. Next, the dipentene and foreign terpenes are taken off, the liquid on the plates being heated sufficiently to hold the vapors at about 200 deg. C. whereby the dipentene and foreign terpenes bubble through the liquid layers of higher-boiling constituents on the plates and pass on to the dephlegmator and thus to the condenser; any entrained camphor is retained by the liquid and returns to the still by reflux. The dephlegmator is heated to hold the vapor at about 200 deg. C. and the condenser is heated to somewhat below 178 deg. C. Thus the dipentenes and foreign terpenes are removed without loss of camphor. Next, the camphor is taken off, the liquid on the plates being heated sufficiently to hold the vapors at a temperature—e.g., between 205.5 and 210 deg. C.—insuring the passing on of the camphor, but below the boiling point of the terpenic acid ester, so that the camphor is freed from the other constituents and, after a final refining in the dephlegmator, which is heated to a temperature to insure the passing of the camphor and retention of the higher-boiling constituents—e.g., 207 to 208 deg. C.—the camphor passes into the condenser, maintained at about 190 deg. C., and is there condensed to a liquid, after which it may be run out and cast into blocks; or the camphor may be condensed in a chamber if preferred. The terpenic acid ester and colophene remaining behind are treated and disposed of in any desired manner. (1,468,371, assigned to E. I. du Pont de Nemours & Co.; Sept. 18, 1923.)

Distillation of High Melting-Point Materials

Another method for preventing freezing while refining camphor by distillation is described by William A. Peters, Jr., in patent 1,466,411, assigned to E. I. duPont de Nemours & Co., issued Aug. 28, 1923.

It is frequently necessary or desirable to refine liquids with high freezing points by distillation, either with or without a fractionating column. If the freezing point of the substance to be

refined is above 100 deg. C., it is extremely difficult, with the ordinary type of water-cooled condenser, to condense the substance to liquid form and at the same time avoid freezing. Unless the condenser is of just the proper size and the flow of cooling water is carefully regulated, the walls of the condenser become covered with solidified material and the whole condenser may become stopped up, thereby causing a dangerous vapor pressure in the still. In some cases this difficulty may be overcome by using hot oil as a cooling agent, but the use of oil requires a bulky and expensive apparatus, and in the cases of those materials, such as camphor which boils at 205 deg. C. and freezes at 176 deg. C., which boil at a temperature only slightly above their freezing points, the use of oil-cooled condensers is not always practicable and it then becomes advisable to recover the vapors by cooling in a current of air or other gas in a so-called subliming chamber.

Mr. Peters places a vertical condenser directly above the still or, if fractionation is desired, at the top of a column. Vapor from the still or column enters the condenser through vertical openings shielded by caps. The vapors are condensed by a series of horizontal cooling coils lying directly across the path of the rising vapors. The condensate collects in the bottom of the condenser, from which it is withdrawn as desired. Construction is such that the condensate can not return to the still.

With this arrangement the rising vapors are condensed in the chamber, and the liquid collecting on the bottom may be withdrawn. If any of the liquid were to freeze as it condenses on the pipes, the newly arriving vapors will not freeze in turn but will condense to a liquid and at the same time tend to melt the solidified mass. The mass forms a non-conductor between the cold pipes and the newly arriving vapors, so that the vapors are not frozen but are merely cooled sufficiently to condense them to liquid form, while their latent heat at the same time tends to melt the mass on the pipes. Thus no material amount of solid distillate collects on the pipes. It will be seen, too, that the condenser has its coils, the bottom and the draw-off pipe, so arranged that the descending condensate travels in, and counter to, the just-arriving vapors hot from the still and thus the descending liquid is kept from freezing. Even with very cold water inside the coils, no objectionable solidification occurs.

Men in the Profession

C. R. BELLAMY has resigned from the coke department of the Semet-Solvay Co. to take up consulting engineering work in association with W. H. Blauvelt. Mr. Bellamy's office will be at 120 Broadway, New York City. He will specialize in coke-oven and other carbonization problems.

ELMER C. BERTOLET is the new secretary of the Philadelphia Section of the American Chemical Society.

CECIL K. CALVERT of Indianapolis, Ind., has been appointed chairman of a committee from the Indiana Section of the American Chemical Society, to work with the municipal fire department in regard to chemical plants in the city, locating the storage places of chemicals and giving information as to proper methods of storing and handling, as well as the most effective ways to fight chemical fires.

A. C. CARLTON, formerly with the Chile Exploration Co. at Chuquicamata, has accepted a position with the Baltimore Copper Works of the A. S. & R. Co.

ANSEL R. CLARK, formerly with the U. S. Department of Commerce, has been appointed general manager of the American Agar Co. of Glendale and San Diego, Calif., and has opened gen-

American Patents Issued October 16, 1923

The following numbers have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff, and those which, in our judgment, are most worthy will be published in abstract. It is recognized that we cannot always anticipate our readers' interests and accordingly this advance list is published for the benefit of those who may not care to await our judgment and synopsis.

1,470,597—Rotary Pulverizer. James John Denny and Rolla Barnum Watson, Cobalt, Ont., Canada.

1,470,637—Acetylene-Aldehyde Fusible Resin. Emil E. Novotny, Logan, Pa., and Donald S. Kendall, Glen Ridge, N. J., assignors to John Stogdell Stokes, Huntingdon Valley Post Office, Pa.

1,470,638—Absorbing Still for Refrigerating Apparatus. Stuart Otto and Jack Carl Jankus, Scranton, Pa.; said Jankus assignor to said Otto.

1,470,650—Method and Apparatus for Coating and Drying Fabric and Other Material. Paul S. Smith, West Barrington, R. I., assignor, by mesne assignments, to O'Bannon Co., West Barrington, R. I.

1,470,656—Process for the Production of Ethyl Chloride. Wilhelm Traube, Berlin, Germany.

1,470,684—Meter for Fluids. Enos B. Cade, Portland, Ore., assignor to American Liquid Meter Co., Portland.

1,470,711—Process for Manufacturing Viscose With a View to the Manufacture of Artificial Silk and Like Products Not Liable to Lose Their Resistance by Contact with Water. Herman Delahaye, Destelbergen, near Ghent, Belgium.

1,470,712—Cleaning Apparatus. Paul E. Demmler, Pittsburgh, Pa., assignor to Westinghouse Electric & Manufacturing Co.

1,470,731—Process for Manufacturing a Mortar-Forming Material From Anhydrite. Fritz Hartner, Homburg, Germany.

1,470,847-8—Gas Producing and Cooling Device. Walter E. Karns, Indianapolis, Ind., assignor of one-eighth to M. A. Wallace, Indianapolis.

1,470,883—Cathode for the Electrolytic Refining of Metals. Charles H. Schuh, Brooklyn, N. Y.

1,470,885—Process for the Production of Propionates and Propionic Acid. James M. Sherman, Washington, D. C., and Roscoe H. Shaw, Chicago, Ill., dedicated, by mesne assignments, to the People of the United States.

1,470,887—Apparatus for Treating Liquids or Solids With Gases. William Sieck, Jr., Chicago, Ill., assignor to Sieck & Drucker, Inc., Chicago.

1,470,892—Air Separator. Thomas J. Sturtevant, Wellesley, Mass., assignor to Sturtevant Mill Co., Boston, Mass.

1,470,919—Drying Apparatus. Hermann Haas, Lennep, Germany.

1,470,950—Machine Used for the Process of Sublimation. Elliot Q. Adams, Berkeley, Calif., by mesne assignments dedicated to the People of the United States for their free use and enjoyment.

1,470,968—Process of Producing Fertilizer. Stapleton D. Gooch, Plant City, Fla.

1,471,015—Liquid Sampler. Philip W. Tompkins, San Francisco, Calif.

1,471,028—Charging Fork for Enameling Furnaces. William Hogenson, Chicago, Ill., assignor to Chicago Vitreous Enamel Product Co., Cicero, Ill.

1,471,052—Method of and Apparatus for Centrifugally Casting Metal Bodies. William D. Moore, Birmingham, Ala., assignor to American Cast Iron Pipe Co., Birmingham.

1,471,054—Art of Producing Centrifugal Castings With a Protective Coating. William D. Moore, Birmingham, Ala., assignor to American Cast Iron Pipe Co., Birmingham.

1,471,058—Process for the Manufacture of Acetaldehyde or Acetic Acid. Hermann Plauson, Hamburg, Germany.

1,471,059—Process for the Manufacture of Rubber and Ebonite Substitutes. Hermann Plauson, Hamburg, Germany.

1,471,088—Oil and Gas Separator. Albert M. Ballard, Yale, Okla., assignor to Sun Oil Co., Philadelphia, Pa.

1,471,101—Gas and Liquid Contact Device. Edwin Cleary, deceased, late of London, England, by Alfred Hutchison, administrator, London, England.

1,471,112—Apparatus for Cooling Air. Frederick R. Ellis, Hyde Park, Mass., assingor to B. F. Sturtevant Co., Boston, Mass.

1,471,131—Separating Device. William M. Adamson, New Brighton, N. Y.

1,471,150—Process for the Preparation of Dyestuffs. Karol Dziewonski, Cracow, Poland.

1,471,189—Method and Apparatus for Forming Sheet Glass. Hubert A. Myers, Toledo, Ohio, assignor to Hubert A. Myers Co., Toledo.

1,471,190—Process of Producing Soft Ferrous Metal Castings. Hubert A. Myers, Toledo, Ohio, assignor to Hubert A. Myers Co., Toledo.

1,471,201—Method of Producing and Material for the Treatment of Oils. Paul W. Prutzman and Carl J. Von Bibra, Los Angeles, Calif., assignors to General Petroleum Corporation, Los Angles.

1,471,213—Manufacture of Formaldehyde Condensation Products of Aliphatic Amines and Products Obtained Thereby. Morris G. Shepard, New York, N. Y., and Harold S. Adams, Naugatuck, Conn., assignors to Naugatuck Chemical Co.

1,471,276—Recovering Valuable Products From Gases. Otto Nordström, Sundsvall, Sweden.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

eral offices at 923 C. C. Chapman Bldg., Los Angeles, Calif.

M. COHEN, formerly a student at the Armour Institute of Technology, is now with the Mafziger Baking Co., at the Kansas City shops, doing work along efficiency engineering lines.

E. C. COLLINS, assistant to H. W. Wilkinson, chairman of the board of directors of the Crucible Steel Co. of America, has been elected president of the company to succeed Dr. JOHN A. MATHEWS, who has resigned to devote his entire attention to special work in the field of metallurgy.

ADAM CRAWFORD has been appointed assistant director of the mining extension department of the University of West Virginia, Morgantown, to succeed Charles K. Brown, resigned.

Dr. HARRY A. CURTIS, professor of chemical engineering at Yale University, is continuing his work in the nitrogen survey at the Bureau of Foreign and Domestic Commerce, giving a portion of each week to the government work until the completion of the investigation. Dr. Curtis can be addressed either at Yale University, New Haven, Conn., or care of the Bureau of Foreign and Domestic Commerce, Washington, D. C.

E. H. DARBY, formerly of the chemical department, Union College, is now head of the research department, Rome Wire Co., Rome, N. Y.

LEWIS DAVIS, who for a number of years was research chemist with Parke, Davis & Co., Detroit, Mich., and who for the past 2 years has been technical director for Brewer & Co., Worcester, Mass., has resigned to enter consulting practice under the firm name of Davis & Bennett, Inc., with offices at 339 Main St., Worcester, Mass.

H. E. FLETCHER, vice-president of the Fletcher Paper Co., Alpena, Mich., has been appointed by Secretary of Agriculture Wallace as a member of the advisory committee of the American pulp and paper interests, to work with the department in formulating and carrying out forestry policies relating to the supply and use of timber in the production of paper and pulp products.

E. H. GILMAN, general superintendent of the Bryant Paper Co., Kalamazoo, Mich., has recently been elected chairman of the Michigan division of the American Pulp and Paper Mill Superintendents' Association, succeeding N. M. BRISBOIS of the Sutherland Paper Co., of the same city. JACOB PARET, superintendent of the Western Board & Paper Co., Kalamazoo, has been elected secretary to succeed GEORGE FOUNTAIN, Monarch division of the Allied Paper Mills, of the same city, who has acted in the capacity of secretary-treasurer since the organization was formed, 4 years ago.

R. G. HALL has opened an office as metallurgical and chemical engineer at 835 Hyde St., San Francisco, Calif.

BAILEY HUTCHINSON has been appointed manager of the Brighton plant of the Great Western Sugar Co., Denver, Colo.

The firm of KIDWELL & BASCOM, INC., has been reorganized by Raymond F. Bacon, C. H. Kidwell and Elizabeth N. Kidwell, under the name of Kidwell & Co., Inc., chemists and chemical engineers, at 27 Thames St., New York. The newly elected officers of the corporation are: C. H. Kidwell, president and treasurer; Raymond F. Bacon, vice-president; Elizabeth N. Kidwell, secretary. The company will continue its research and consulting business at its office and laboratory at 27 Thames St., New York.

CHARLES C. KURTZ has been appointed receiver for the Liberty Morocco Co., with tannery at Wilmington, Del.

Dr. S. C. LIND, chief chemist of the Bureau of Mines, will address the Chemical Club at Princeton University on Nov. 8. His subject will be "Are Gaseous Ions Chemically Active?"

A. W. LISSAUER has resigned as vice-president of W. L. Fleisher & Co., New York City, with which company he has been associated for 12 years, to become president and general manager of the Louisville Drying Machinery Co., Louisville, Ky. JULIUS CREDO, formerly sales manager of the Louisville Drying Machiney Co. and recently with W. L. Fleischer & Co., Inc., as Western representative, will return to the Louisville Drying Machinery Co. as vice-president and sales manager.

Dr. DORSEY A. LYON, of the Bureau of Mines, will be at the bureau's Northwest Experiment Station, Seattle, Wash., until about Dec. 1.

JAMES W. MARTIN, JR., formerly with the Union Carbide & Carbon Chemical Corporation, is now assistant to the general superintendent of the Jones & Laughlin Steel Corporation, Woodlawn, Pa.

ALEXANDER J. MCKAY has taken up his duties as general manager of the Eddy Paper Co., Three Rivers, Mich. He was previously vice-president of the Seaman Paper Co., Chicago, Ill.

W. J. PRIESTLEY has recently assumed duties as metallurgical engineer for the Electro-Metallurgical Sales Corporation, New York City.

FOREST RUTHERFORD, mining and metallurgical engineer, has returned to New York from Ontario, Canada, where he went to examine some mining properties.

Dr. E. I. SHAW, assistant chief chemist of the Bureau of Mines, lectured on helium before the Piney Branch Citizens' Association, Washington, on Oct. 16.

Dr. R. B. SOSMAN of the Geophysical Laboratory, Washington, D. C., has been appointed by the National Research Council as American member on the permanent committee for the standardization of physicochemical symbols of the International Union of Pure and Applied Chemistry. The other members of the committee are: Prof. Ernst Cohen, University of Utrecht, chairman; Prof. Alexander Findlay, University of Aberdeen, and Prof. Charles Marie, Sorbonne.

A. T. WARD, who has been associated with the Union Carbide & Carbon Corporation, New York, has gone in business for himself, operating under the name of Acme Coal Mining Sales Corporation, with offices at 20 Broad St., New York, N. Y.

D. W. WILSON has resigned from the staff of the Massachusetts Institute of Technology, to become a chemical engineer with the Iroquois Gas Co., Buffalo, N. Y. Mr. Wilson has been in charge of the coke-oven research done by the Institute at its Buffalo station, and will continue this type of research and development work in connection with a new plant planned by his company.

At the meeting of the National Safety Council, at Buffalo, N. Y., Oct. 1 to 5, the following officers were elected:

President, L. A. DeBlois, E. I. du Pont de Nemours & Co., Wilmington, Del.; vice-president in charge of general activities, C. B. Auel, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.; vice-president in charge of public safety, Marcus A. Dow, executive secretary, Bureau of Public Safety, Police Department, New York City; vice-president in charge of local councils, George T. Fonda, Fonda-Tolsted, Inc., Woolworth Bldg., New York City; vice-president in charge of industrial safety, H. A. Reninger, Lehigh Portland Cement Co., Allentown, Pa.; vice-president in charge of public relations, David Van Schaack, Aetna Life Insurance Co., Hartford, Conn.; vice-president and treasurer, Homer E. Niesz, Commonwealth Edison Co., 72 W. Adams St., Chicago.

Calendar

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, seventy-fifth anniversary meeting, University of Cincinnati, Cincinnati, Ohio, Dec. 27 to Jan. 2.

AMERICAN CONCRETE INSTITUTE, annual meeting, Chicago, Feb. 25 to 28, 1924.

AMERICAN ELECTROCHEMICAL SOCIETY, forty-fifth meeting, Hotel Bellevue-Stratford, Philadelphia, April 24 to 26, 1924.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, winter meeting, Washington, D. C., Dec. 5 to 8.

AMERICAN MANAGEMENT ASSOCIATION, Hotel Astor, New York, Oct. 29 to 31.

AMERICAN PETROLEUM INSTITUTE, fourth annual meeting, Statler Hotel, St. Louis, Mo., Dec. 11 to 13.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, annual meeting, New York City, Dec. 3 to 6.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, annual convention, New York City, Dec. 3 to 5.

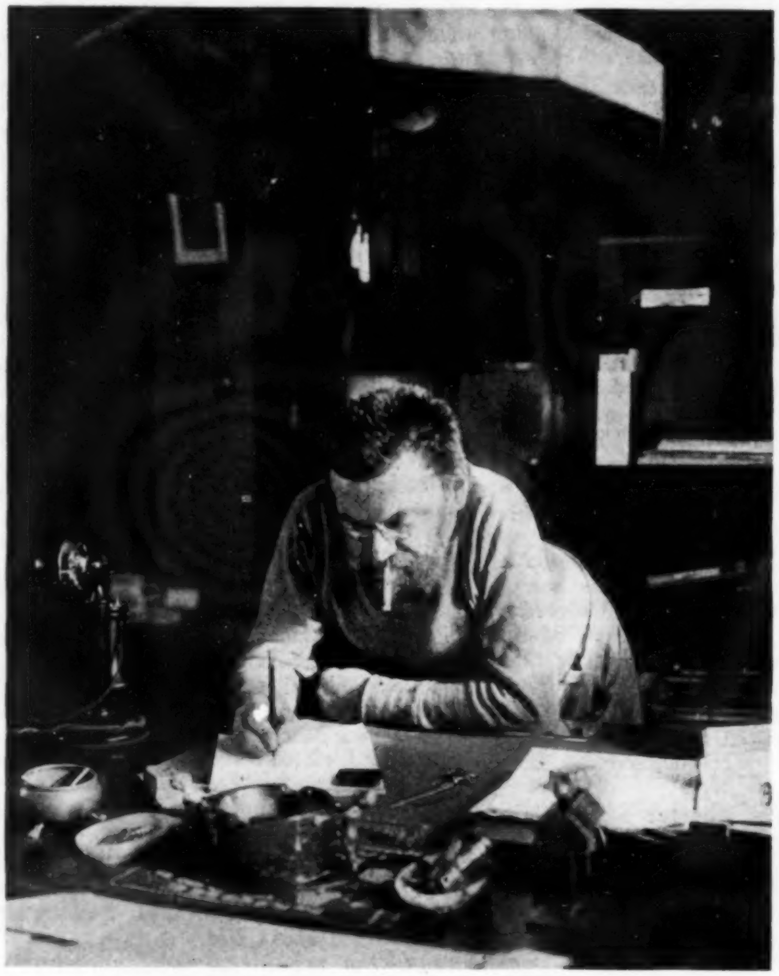
NATIONAL ASSOCIATION OF PRACTICAL REFRIGERATION ENGINEERS, fourteenth annual convention, Memphis, Tenn., Dec. 12 to 16.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING, Grand Central Palace, New York. Dec. 3 to 8.

SOCIETY OF AUTOMOTIVE ENGINEERS, annual meeting, simultaneously with the Detroit Automobile Show, General Motors Bldg., Detroit, Mich., Jan. 22 to 25, 1924.

Charles Proteus Steinmetz

Who died in Schenectady, Oct. 26, 1923.



THERE are some mountain peaks that dominate a valley, and with their massive proportions and abrupt precipices the people of the valley become familiar. There are other mountain peaks often vaster, more impressive, more precipitous, more dominating, that are invisible from the valleys because they are surrounded by high mountains. The inspiration and effect of their presence are reserved for those who are intrepid enough to scale the nearby peaks and come into direct view of their magnificence. Then when the mountaineers return they cannot tell the valley people much about the experience except that they have seen a Titan.

Great men are like mountains. The achievements of some are visible to all of us, the people of the valleys, and of others we only know that they are great because others say so. We cannot point to their achievements and exclaim, "Behold a genius!" Their skill may lie in those domains beyond our comprehension. Of such a cast was Steinmetz.

What did he do? No single thing stands out above all others as a chef d'œuvre. It is rightly so. Steinmetz did no single thing that could serve to make him memorable. Perhaps to understand his service to mankind it would be better to remark the progress of these 30 years just past in making electricity a useful tool for man; in giving to the common man luxuries that princes could not buy before; in making labor less severe, more healthful, better paid. This progress has been built on careful, detailed, brilliant, scientific work and on the deft translation of this fundamental knowledge into engineering measure and design. In this great progress he was a virile force, and there will be none who will not yield to him a foremost place.

That in itself is tribute not to his genius only but to his personality. Void of all love of personal aggrandisement and amazingly without conceit, his own success did not make jealous colleagues. We prize a letter from him when he sent us some well-remembered articles dealing with his work on the study of nitrogen fixation by the electric arc. "That others may build where I have left off" was his main reason for publishing the material. To most the idea of attempting to build on that structure would have been like building a haystack on a mountain top.

His career has been like his work —a consistent steady progress. Born in Breslau in 1865, he was still under 60 when he died of an illness brought on by the physical hardships of a lecture tour. He came here 35 years ago and for 30 years had been in one job. The firm that first employed him was bought out by the General Electric Co. and he went into it as consulting engineer and was still there when he died. By readjustment will the work he did be carried on. He cannot be replaced.

News of the Industry

Summary of the Week

Forthcoming suit against Standard Oil Co. prompts interest in technology of petroleum refining.

Trend of opinion in Canada is against pulpwood embargo.

December meeting of American Institute of Chemical Engineers will include program to promote understanding of government bureau activities.

Dr. Becket elected Perkin medalist.

Recent agreement among American, British and Swiss indigo producers may lead to entente embracing chemical industries of those countries.

Large asbestos groups in Canada may be merged into one corporation.

Tariff Commission will send experts abroad to study production costs of plate glass.

New contract prices on caustic soda and soda ash represent decline from recently prevailing levels.

N. B. Gregg, vice-president of the National Lead Co., elected president of the National Paint, Oil and Varnish Association.

Code of ethics proposed by American Institute of Chemists.

Import and Export Trade in Chemicals Declines in September

Fertilizer Materials Present Notable Exception, With Large Gain in Exports—Soda Compounds Below August Totals

A FURTHER slight decrease in exports of chemicals and allied products occurred during September. The aggregate value of the exports during that month was $9,770,684. This is about $300,000 less than the value of exports during August, but exceeds exports for the month of September, 1922, by $1,500,000.

While the general tendency was toward a decline in exports, there was a notable exception in the case of fertilizers and fertilizer materials. The September total was $1,965,533, which was more than half a million dollars greater than the exports in August and exceeded those of September, 1922, by $1,000,000.

Coal-Tar Exports Decrease

Coal-tar products valued at $638,532 were exported during September. This represents a decrease of nearly a quarter of a million dollars, as compared with the volume of exports in August.

Sodas and sodium compounds to the value of $753,686 were exported in September, which shows only a slight decrease as compared with exports during August.

A more decided slump occurred in the exports of pigments, paints and varnishes. This total fell to $1,380,154, nearly $400,000 less than the August exports. The figures are those of the Department of Commerce.

The figures covering the commodities in which decided changes are shown follow:

	Sept., 1922	Sept., 1923
Acetic acid, lb.	504,532	29,296
Sulphuric acid	258,114	810,832
Wood and denatured alcohol, gal.	112,448	77,351
Ammonia and ammonium compounds, lb.	859,137	242,507
Ammonium sulphate	1,915,683	2,955,601
Acetate of lime	1,466,815	222,772
Chlorinated lime	2,949,034	1,692,366
Dextrine	1,671,806	620,194
Formaldehyde	107,643	458,115
Borax	1,232,411	2,884,854
Soda ash	2,147,965	2,882,502
Carbon and lamp black	840,932	2,276,908
Sulphate of ammonia, tons	9,354	11,531

Imports also declined. The total value of free-list chemicals brought in during September was $5,788,252. This was half a million dollars less than the imports in that group during August. In the importation of dutiable chemicals, the decline was less marked. The value of all such imports during September was $2,419,384, or slightly more than $300,000 less than the imports during August. There was a slight increase, however, in the value of the coal-tar chemicals brought in. The September total was $1,295,167, which is $200,999 greater than the importations during August. Paints, pigments and varnishes were imported in less volume than in August, falling to the low mark of $184,206.

The imports of fertilizer materials during September were valued at $4,166,011. This is three-quarters of a million dollars less than the August total. The exceptional changes, as shown by the September returns, are as follows:

	Sent., 1922	Sept., 1923
Creosote oil, gal.	4,127	5,890,598
Naphthalene, lb.	105,043	1,545,952
Carbolic acid	280,224	20
Alizarin	78,376	9,652
Synthetic indigo	14,257	....
Alkalis	2,129,869	....
White arsenic	....	1,480,482
Cyanide of potash	1,114,298	....
Cyanide of soda	667,168	1,140,122

Free Lectures on Chemistry for Salesmen and Others

In many cities such as New York and Philadelphia, lectures are being given on general and organic chemistry by universities and other agencies for salesmen and persons working with chemical firms who wish to improve their knowledge of general chemistry. In order that the Public Lecture Bureau of the City of New York may serve a wider group of persons and meet the special needs of this group, the Board of Education of New York City is offering in the Doremus Lecture Theater of the Chemistry Building of the College of the City of New York a series of eight free lectures by Dr. W. L. Estabrooke. The list of topics selected for coming meetings with the dates for each (Monday evenings) is as follows: Oct. 29, "Types of Changes in Industry"; Nov. 5, "Oxygen and Ozone"; Nov. 12, "Hydrogen, the Lightest Gas in the World"; Nov. 19, "Water (Hard and Soft)"; Nov. 26, "Water in Common Substances"; Dec. 3, "Water in Daily Life"; Dec. 10, "The Atmosphere and Liquid Air."

The first lecture of the series, on "The Tools of a Chemist and His Method of Work," was delivered on Oct. 22.

Forthcoming Suit Against Standard Oil Prompts Interest in Technology of Petroleum Refining

Dr. Gustav Egloff Discusses Past and Future of Industry—Believes Billion Barrel Production Will Hold for Twenty-five Years

THE Southern California Section of the Americal Chemical Society met at Los Angeles on Oct. 12 to hear Dr. Gustav Egloff, director of research for the Universal Oil Products Co., of Chicago, discuss the refining of petroleum. Particular interest centered in the topic in view of the suit being brought by the Universal company, in which $100,000,000 damages are claimed, against the Standard Oil Co. of Indiana, for alleged infringement of certain patents issued to protect the Dubbs cracking process.

Dr. Egloff emphasized the importance of the industry in citing statistics which showed that since August, 1859, when the first (Pennsylvanian) well was brought in, seven billion barrels of petroleum have been produced. It took 41 years to deliver the first billion barrels, and but 19 months to deliver the last billion barrels. Dr. Egloff's estimate of future development in the oil industry, and in spite of geological opinion to the contrary, was that an output of one billion barrels will continue to be maintained from the wells of the United States for 25 years to come. The enormous output from three fields in the Los Angeles district—Huntington Beach, Long Beach and Santa Fe—is significant of future supply. To cope with increasing demands for storage, heroic measures are being taken to provide adequate tank capacity. An immense concrete reservoir is now being constructed by the Standard Oil Co. of California at its tank farm at El Segundo, which will have a capacity of 3,160,000 bbl. This will bring the total storage capacity of this farm to about 20,000,000 bbl.

Cracking Methods Available

Dr. Egloff stressed the fact that the development of the refining industry has been accompanied by enormous expenditures for experimental work. Cracking methods have been developed along three main lines for the production of gasoline from petroleum—(1) vapor-phase cracking, (2) by the use of catalysts and (3) by the liquid-gas phase reaction. The first of these, vapor-phase cracking, is now used nowhere, in spite of any impression to the contrary that may be gained by the perusal of recent textbooks on the refining of petroleum. Aluminum chloride as a catalyst was patented in England in 1877, and recent suggestions are merely adaptations of the original idea. All the methods mentioned are limited in application to low coke-forming oil —the amount of coke present must be less that 0.2 per cent of the weight of the oil. The aluminum chloride method is applicable only when the oil is absolutely dry; immense amounts of the catalyst would be needed in the event of general application. The sulphur content of the oil must be low.

Coking Limits Cracking

The success of the Dubbs process, according to the speaker, is evidenced by the fact that units are now in successful operation in Wyoming, California, Texas, Kansas, Oklahoma, New York and New Jersey; others are in construction in Venezuela, Japan, Rumania and England. The important feature of the process is that, whereas plants operating on all other systems must shut down when a comparatively small amount of coke has accumulated in the system, the Dubbs plant operates successfully until about 30 tons of coke has formed. A typical plant operating on Mid-Continental oil of 32 deg. Bé. will handle 76,000 bbl. of petroleum per day and operate for 12 days before a shut-down is necessary to remove coke. In conclusion, Dr. Egloff predicted 20-cent gasoline within 6 months. There were no profits in sight for the refineries at the present selling price, which was absurdly low in comparison with the cost of filtered water in Los Angeles.

Production Costs of Linseed Oil Under Investigation

Three groups of investigators of the Chemical Section of the Tariff Commission left Washington Oct. 27 to visit domestic producers of various chemicals in which inquiries into costs of production have been ordered by the commission following applications for changes in duties under the terms of the flexible tariff.

R. H. Cragg and W. T. Towestadt left for the Middle West to investigate costs of producing linseed oil. Dexter North and B. J. Heacock left for Buffalo and other Eastern centers to visit crushers in connection with the same investigation.

F. A. Talbert and M. Braun went into the field to investigate domestic plants producing phenol, cresolic acid, thymol, synthetic phenolic resins, rare sugars and amino acids and amino salts.

The foreign investigations into most of these chemical products have been completed.

Dust Explosion Proves Costly

Dust explosion in the plant of the Becker & Moore Co., located on Tonawanda Island, North Tonawanda, recently caused a $50,000 loss by fire and severely injured three men. The Becker & Moore Co. takes the shavings from a large number of lumber mills in the neighborhood and grind them into powder for a company which manufactures floor coverings. The explosion occurred following a flash from an electric motor in the engine room.

It is said that the interior of the mill was covered with fine dust accumulated from the manufacture of its products. The interior of the mill was in flames almost instantly, the only part saved being that separated from the main plant by a stone wall. Considerable damage was done to the shaving building and engine room of the Northern Lumber Co., adjacent to the Becker & Moore Co.

Suit on Oil Cracking Shifts to Kansas City

On Oct. 26 Kansas City, Mo., momentarily became the center of interest in the extended litigation over the Burton-Dubbs oil-cracking patents. The trial, which has been in progress for several months in the courts of Los Angeles, Calif., recessed long enough to permit the Kansas City hearings, which will probably take a week or so. It has been made known that Colonel William H. Walker will probably go on the witness stand in the interest of the Dubbs case.

The scene will then shift back to Santa Maria, Calif., for a series of tests in a Dubbs apparatus, to be operated by the Standard Oil Co.'s representatives for their presentation of the case. The Standard company was denied the motion to have the experiments carried out by a committee of disinterested scientific experts."

Delaware Section, A.C.S., to Study Coal on Market

The Delaware Section of the American Chemical Society held its regular monthly meeting at the Lambros Restaurant, Wilmington, Del., Oct. 18, the business session being preceded by a dinner, with Fred C. Zeisberg, president of the section, presiding. Members of the local Hercules Club were in attendance. The principal address was made by W. M. Corse, National Research Council, Washington, D. C., dealing with a technical discussion of nickel and its uses, illustrated with a number of interesting motion pictures, showing important works in the United States and Canada in this line of industry. Ernest M. Symmes of the operating division of the Hercules Powder Co. tendered an interesting talk on coal, covering a technical analysis of fuel now being sold locally and misrepresentations of alleged hard coal now evidenced. A committee was appointed consisting of Mr. Symmes, Dr. C. M. Stone, assistant director of the chemical division of the du Pont company, and H. V. Berg, Krebs Pigment & Chemical Co., to investigate the character of coal now being sold in the open market at Wilmington.

News in Brief

The recent additions made at the plant of the Barnet Leather Co., Little Falls, N. Y., make this the largest exclusively calfskin tannery in the world. The capacity is rated at 16,000 skins per day. It is expected to maintain full production for an indefinite period, giving employment to a full working force.

Birmingham, Ala., iron pipe makers are considerably alarmed over the fact that a considerable amount of iron pipe from France is being imported into this country and that France is now supplying much of the foreign trade with iron pipe that formerly came to America.

Sugar beet production in Czechoslovakia has taken a decided spurt this year, according to official figures. After several years of stagnation the area under cultivation shows an increase of nearly 19 per cent. All of the Czechoslovakian sugar factories have been put in shape to handle large quantities of beet.

A bibliography on corrosion has recently been published. This was prepared by N. Van Patten, assistant librarian at M.I.T., and includes the theory of corrosion, of both ferrous and non-ferrous metals, electrolysis, and the prevention of corrosion by alloying, metal-coating, passivity, painting, etc.

The first fall meeting of the Kansas City Section of the Americal Chemical Society was held on the evening of Oct. 20 at the Kansas City College of Pharmacy. Prof. H. M. Elsey of the University of Kansas spoke on "Radium and Radioactive Compounds."

The Union Minère plans to build a 35,000-ton electrolytic copper plant, say recent advices received in this country. The plan is being heralded as the first step toward making Europe independent of American electrolytic copper.

Henry Ford interests are investigating the possibilities of some undeveloped territory in the lead district of St. Francois County, Missouri. Options have been secured on a large acreage and test drilling is now under way. If these drillings show sufficient metal value, immediate development is expected.

The Department of Commerce is presenting a chemical exhibition at the Boston Textile Show, which opened last Wednesday. The exhibit was made possible by the co-operation of various chemical interests. The exhibit is in the immediate charge of Frank B. Gorin and Major H. B. Kimberly.

Whether or not ore-dressing methods used in connection with the beneficiation of metalliferous ores may be applied practically to some of the nonmetallics is to be the subject of discussion at a meeting in the near future of the Bureau of Mines non-metals specialists.

Code of Ethics for Chemists Is Proposed

American Institute of Chemists Patterns Its Code on Lines Similar to Those of F.A.E.S

The committee appointed by the executive council of the American Institute of Chemists to consider and draw up a code of ethics for the Institute has reviewed the codes which have been used by the various professional societies for the guidance of their respective members. It is said that the report of the joint committee appointed by the Federated American Engineering Societies to consider the question of a code of ethics for all engineers appeared to the present committee to be an excellent one. The committee, therefore, felt that the American Institute of Chemists could not do better than adopt it for its own use, with appropriate changes. The adaptation of these principles to the chemical profession is set forth as follows:

The Proposed Code

The profession of chemistry is an ancient and an honorable one. With it to a large degree rest the welfare and prosperity of the community. To render effective service it is entitled to the highest consideration. This result can be best secured by maintaining a high standard of personal conduct among the individuals in the profession.

All members of the Institute are, therefore, urged to conform to the principles laid down in the following code of ethics.

1. Each member of the Institute will carry on his professional work in a spirit of fairness to employees and contractors, fidelity to clients and employers, loyalty to his country, and devotion to high ideals of courtesy and personal honor.

2. He will refrain from associating himself with, or allowing the use of his name by, an enterprise of questionable character.

3. He will advertise only in a dignified manner, being careful to avoid misleading statements.

4. He will regard as confidential any information obtained by him as to the business affairs and technical methods or processes of a client or employer.

5. He will inform a client or employer of any business connections, interests or affiliations, which might influence his judgment or impair the disinterested quality of his services.

6. He will refrain from using any improper or questionable methods of soliciting professional work, and will decline to pay or accept commissions for securing such work.

7. He will accept compensation, financial or otherwise, for a particular service, from one source only, except with the full knowledge and consent of all interested parties.

8. He will not use unfair means to win professional advancement or to injure the chances of another chemist to secure and hold employment.

9. He will co-operate in upbuilding the chemical profession by exchanging general information and experience with his fellow chemists and students of chemistry and also by contributing to work of chemical societies, schools of applied science and the technical press.

10. He will interest himself in the public welfare, in behalf of which he will be ready to apply his special knowledge, skill and training for the use and benefit of mankind.

The committee further recommends that a standing committee on professional conduct be appointed to interpret the rules laid down in this code and that this standing committee be empowered to consider infractions of the code and make such representations as may be deemed necessary to the executive council of the Institute.

The committee in concluding this report wishes to express its obligation to the joint committee of the Federated American Engineering Societies, whose constructive work has produced an instrument which in the opinion of the committee it would be difficult to improve.

Chemical Salesmen's Association May Limit Membership

A meeting of the executive committee of the Salesmen s Associat.on of the American Chemical Industry was held at the Chemists' Club on Oct. 16. Ralph E. Dorland, president of the association, was in charge of the meeting and led a discussion of plans for the coming year and outlined a tentative program.

One of the important matters discussed related to the limiting the number of memberships in the organization. This question will be brought up at the November meeting of the association.

New members were elected as follows: J. C. McKenna, W. F. George Chemicals, Inc.; Alexander Williams, Chemical Foundation, Inc.; Arthur W. Wright, New York *Commercial;* Millard F. Taylor, New York *Commercial;* H. L. Powell, Chemical Catalog Co.; J. F. Blackie, Newport Chemical Works; I. G. Ammen, Bowker Chemical Co.; Frederick A. Koch, Dow Chemical Co.; W. C. Mills, Grasselli Chemical Co.; N. Townsend Thayer, E. M. Sergeant Co.; A. P. Howes, *American Dyestuff Reporter;* William O. Thompson, Grasselli Chemical Co.

A winter course consisting of a series of lectures is contemplated. These will probably cover such important subjects as economics, traffic problems, commercial law, business finance, etc.

The following committee chairmen were appointed: Dr. F. P. Summers, Noil Chemical & Color Works, chairman committee on membership; John A. Chew, Warner Chemical Co., chairman committee on general affairs; E. H. Bedell, *Chemical & Metallurgical Engineering*, chairman of publicity committee. Associate members of committees will be announced later.

Washington News

Tariff Commission Investigates Plate Glass Costs

J. Mark Albertson and Joseph E. Gregory will go to Europe under the direction of the United States Tariff Commission. They will study production costs of plate glass in different centers abroad. The data secured by them will be used in connection with the investigation which is being made under the flexible provision of the tariff law.

A. V. Dye Made Commercial Attache at Mexico City

Alexander V. Dye of New York City, who has been acting as trade commissioner at London for the past 2 years, has been appointed commercial attaché at Mexico City, Mexico. This announcement was made public last week by Secretary Hoover. Mr. Dye had sailed from London for this country in the preceding week and is expected to proceed at once to his new position in Mexico City.

Davis Retained by State Department

The Federated American Engineering Societies has announced that Arthur P. Davis, whose recent dismissal as director of the U. S. Reclamation Service by Secretary of Interior Work caused a nation-wide protest by engineers, has been retained by the State Department as technical adviser in connection with certain claims against the United States by British citizens which are to be tried before the Pecuniary Claims Arbitration Commission in London beginning Nov. 6.

The arbitration of these claims was provided for by a special law of Congress to clear the docket of old pending claims which have not been settled.

Mr. Davis sailed for England Oct. 23 on the "Aquitania" to assist in the preparation of these cases prior to their consideration.

United States Largest Buyer of Malaga Iron Oxide

Among the more important products exported from Malaga is red oxide of iron. It is mined to some extent in the Province of Malaga, but principally in the mountainous regions in the Province of Jaen. The crude ore is carried from the mines to the railroad for transporting to Malaga, where it is levigated.

The ore milled in Malaga is reputed to be of very good quality, not equal in color to the more expensive variety mined in the Persian Gulf region, but much higher in ferric-oxide contents and therefore of more value as a preservative for iron and woodwork. Moreover, the Persian ore is shipped only in the crude form, there being no levigating nor grinding plants on the island of Ormuz nor in Persia.

The levigating establishments which are located in Malaga reduce the crude ore to a fine pulverized form after having extracted all impurities. The systems of levigation vary, but the most satisfactory appears to be "water floating," which is accomplished by passing the mineral through a series of tanks so that only the very finest particles in suspension ever reach the final or settling tank.

The red-oxide industry has expanded considerably during the last 10 years, as is evidenced by the following figures of levigated ore exported to the United States alone:

	Quantity Lb.	Value
1913	1,336,968	$13,938
1918	4,419,764	141,339
1919	4,333,482	139,258
1920	7,459,583	178,314
1921	7,669,665	176,886
1922	9,196,123	192,177
1923 (first 6 months)	6,705,542	133,775

As may be seen from the above figures, the greatest increase has occurred during the past 3 years. This is accounted for by the growing use of paints in construction work of all kinds. The present boom in construction, which is most notable in England and the United States, has substantially aided the red-oxide trade. The cement and rubber trades also now consume large quantities, and a large amount is used in paper staining.

Approximately 60 per cent of the ore exported from Malaga is shipped to the United States, about 30 per cent goes to the United Kingdom, and the remaining 10 per cent is taken by various other countries.

Chemical Production in 1921 Far Below Maximum Capacity

Plants engaged in the manufacture of chemicals were operated at 49.1 per cent of their maximum capacity during 1921, figures just made public by the Bureau of the Census show.

During that year 692 plants were engaged in the manufacture of chemicals. They manufactured products valued at $390,768,434. Had they operated at the maximum of their respective capacities, they would have manufactured products valued at $795,521,170.

Other figures of chemical interest include the following:

Industry	Number of Establishments	Value of Products	Possible Output	Per Cent of Possible Output
Carbon black, lamp black, etc	45	$8,180,844	9,977,703	82
Dyestuffs and extracts	123	28,310,708	58,787,667	48.2
Fertilizers	588	180,374,789	357,743,684	50.4
Oil and cake	610	217,225,030	417,059,229	52.1
Oil, essential	27	3,421,690	6,468,447	52.9
Oil, linseed	28	71,032,261	115,548,686	61.5
Acids	36	21,462,920	37,328,173	57.5
Naval stores	1,062	23,300,845	28,353,935	82.2
Varnishes	222	71,239,183	117,812,161	60.5
Paints	582	203,071,131	331,559,028	61.3

The figures were compiled as a result of recommendations by the committee on census schedules created at a conference of trade associations, which met in Washington in 1921 at the instance of the National Association of Manufacturers. Nathan B. Williams was chairman of the committee.

The percentage of possible output among all of the industries shown on the return was 56.8. This covers 194,194 establishments, with a combined value of products of $42,318,241,453. Had these plants worked at maximum capacity, they would have produced $74,123,930,736.

Prohibition Laws Do Not Check Commercial Alcohol Movement

The only reference made to industrial alcohol by the Prohibition Commissioner in his speech at the White House Oct. 20 before the Governors of the several states, was as follows:

"Following the World War, there was built up in this country a large commercial industry of highly specialized interests, which undertook to supply the domestic market with many commercial products, formerly manufactured in Germany and Austria. The manufacture and distribution of alcohol as a raw material on as economical, commercial basis as possible was essential to the continued success of these newly established industries. There are approximately seventy of these plants in operation, working at greater capacity than at any time during the last 2½-year period.

"To illustrate: Releases of industrial alcohol for the fiscal year ended June 30, 1921, totaled 44,047,442 gal., for the fiscal year ended June 30, 1922, totaled 41,691,771 gal.; for the fiscal year ended June 30, 1923, totaled 60,662,201 gal., showing an increase of more than 19,000,000 gal. over 1922, demonstrating clearly that the administration of the alcohol laws has in no way interferred with normal commercial purposes."

Canadian Asbestos Merger

The Asbestos Corporation of Canada is negotiating for the purchase of five other groups holding asbestos properties, according to a report from Montreal. This would mean a combination of the most important asbestos mines in the Province of Quebec.

It is believed that combination of mines would effect a large saving in selling and would enable money to be raised for development, particularly the installation of machinery to deal with the lower grades of ore.

Program Drawn Up for A.I.C.E. Meeting in Washington

Development of Understanding Between Government Bureaus and Chemical Engineers Furnishes Keynote of December Sessions

THE tentative program for the sixteenth annual meeting of the American Institute of Chemical Engineers, which will be held in Washington, Dec. 5, 6 and 7, has been drawn up. As the auditoriums at the various bureaus are not large enough to accommodate all those who will be in attendance at the meeting, it has been decided that all sessions will be at the Willard Hotel. This will in no way interfere with the plan to make tours of the bureaus in which chemists are particularly interested. The tentative program is as follows:

Wednesday, Dec. 5.

Meeting at New Willard Hotel

Symposium on Work of Bureau of Mines

8:30 to 12 M—Registration at New Willard Hotel.

10 a.m.—Address of welcome by Major J. Franklin Bell, Engineer Commissioner, District of Columbia; Response by President Henry Howard; "The Relations of the Geological Survey to Chemical Engineering," Dr. George Otis Smith, Director of the Geological Survey; "The Relations of the Bureau of Mines to Chemical Engineering," H. Foster Bain, Director of the Bureau of Mines; "Combustion of Coke, a Typical Bureau of Mines Problem of Importance to the Chemical Engineer," A. C. Fieldner; "The Relation of the Chemical Work of the Bureau of Mines to Chemical Engineering," S. C. Lind; "Testing of Explosives for Governmental and Commercial Use," J. W. Paul; "The Fuel Research of the Bureau of Mines," O. P. Hood; "Research on Petroleum," H. H. Hill; "Oxygen Enrichment," D. A. Lyon.

1 p.m.—Luncheon at the New Willard Hotel.

2 p.m.—Visit to the Cryogenic Laboratory.

8 p.m.—Entertainment and dance, New Willard Hotel. Motion-pictures, address, dancing.

Thursday, Dec. 6.

Meeting at Bureau of Standards

9:30 a.m.—Business session. Canvass of ballots for officers; reports of officers and council; reports of committees.

10:30 a.m.—Papers. "The Policies, Problems and Practices of the Bureau of Standards," G. K. Burgess; "The Chemical Work of the Bureau of Standards," W. F. Hillebrand; "The Industrial Research of the Bureau of Standards," P. H. Bates; "Atomic Physics and Its Bearing Upon Chemical Engineering," P. D. Foote; "Thermal Research as a Guide to Engineering Practice," H. C. Dickinson; "Commodity and Raw Material Surveys of the Department of Commerce," Julius Klein.

1:30 p.m.—Luncheon at the Bureau of Standards.

2 p.m.—Inspection of the Bureau of Standards.

4 p.m.—Inspection of the Geophysical Laboratory of the Carnegie Institution of Washington.

7 p.m.—Subscription dinner at the New Willard Hotel.

Friday, Dec. 7.

Meeting at New Willard Hotel

8:30 a.m.—Business session.

10:30 a.m.—Reading of papers. "The Research Program of the Department of Agriculture," Dr. E. D. Ball, Director of Research, Department of Agriculture; "Work of the Bureau of Chemistry," C. A. Browne; "Forest Products in the Chemical Industry," Dr. L. F. Hawley, in charge of Section of Derived Products, Forest Products Laboratory, Forest Service; "Fixed Nitrogen Research," F. G. Cottrell; "Fertilizers and Soil Fertility," Milton Whitney; "Animal Products and By-products," John R. Mohler; "Plant Products, Chemical Raw Materials," W. A. Taylor; "Marketing of Farm Products," H. C. Taylor.

1 p.m.—Luncheon at New Willard Hotel.

2 p.m.—Visit to laboratories of the Department of Agriculture: Bureau of Chemistry, Bureau of Animal Industry, Bureau of Plant Industry, Bureau of Entomology, Bureau of Soils, Forest Service. Buses will be furnished to visit the Fixed Nitrogen Laboratory, Color Laboratory at Arlington.

8:30 p.m.—Meeting at the New Willard Hotel. General papers.

Saturday, Dec. 8.

Meeting at New Willard Hotel

9:30 a.m.—General papers.

Ladies' Program

Wednesday, theater party in the evening. Thursday, 9 a.m., automobiles will leave New Willard Hotel for Mount Vernon, Alexandria and Arlington; 7 p.m., subscription dinner. Friday, trips to Bureau of Printing and Engraving, National Museum, Lincoln Memorial, Pan-American Building, Freer Art Gallery, Smithsonian Institute, Corcoran Art Gallery, Library of Congress.

Anti-Knock Gas for General Distribution

A contract has been entered into between the General Motors Corporation and the Standard Oil Co. of Indiana for the distribution of ethyl fluid, the new addition agent for gasoline developed by General Motors Research Corporation. It has the effect of increasing engine efficiency and of taking the knock out of an engine, no matter under what conditions or load an automobile is driven. It is the result of several years research and test at the laboratories of the General Motors Research Corporation in Dayton, and has met with enthusiastic reception from motorists in Dayton and in Cincinnati, where it has been placed on sale at a few stations. Gasoline treated with ethyl fluid has a characteristic light wine color, which distinguishes it from other automobile fuels.

Distribution by the Standard Oil Co. of Indiana will cover the states of Indinana, Michigan, Illinois, Minnesota, Wisconsin, Iowa, Missouri, Kansas, South Dakota and North Dakota as quickly as installation can be made. This installation will be started in Indiana and carried through Illinois, into Missouri and Kansas. The southern part of the distributing territory is being equipped this winter and the northern part will be equipped as early as possible in the spring, in order that motorists may be supplied when the 1924 motoring season opens. It is believed that all the Indiana company service stations will be open and ready to supply the treated fuel by July 1, 1924.

Pottery Installs Bonus System

The Thomas Maddock's Sons Co., Trenton, N. J., manufacturer of sanitary ware, has adopted a bonus system for casters and pressers at its plant, and the results of the first month of operation indicates the possibilities of marked success. The plan has been installed voluntarily, covering a bonus over and above the piece-work schedule now operative; it is to be paid monthly and will be based on the amount of charge-back loss of each individual worker in the departments. Ware that is poorly finished, showing careless workmanship, will be charged against the bonus, even if not charged back in the regular way. The bonus arranged is as follows: No loss of ware during the month, 10 per cent of wages; loss of less than 2 per cent, 6 per cent of wages; loss of 2 per cent and above, but less than 4 per cent, 4 per cent of wages; loss of 4 per cent and above, but less than 5 per cent, 2 per cent of wages; loss of 5 per cent of ware and over, no bonus. During the initial month of operation, August, the results were: Casters—10 per cent received a 10 per cent bonus; 47 per cent received a 6 per cent bonus; 34 per cent received a 4 per cent bonus; 4½ per cent received a 2 per cent bonus; and 4½ per cent of working force received no bonus. Pressers—22½ per cent received a 10 per cent bonus; 33 per cent received a 6 per cent bonus; 11 per cent received a 4 per cent bonus; 11 per cent received a 2 per cent bonus; and 22½ per cent of working force received no bonus.

Chemical Interests May Form Working Agreement

British, Swiss and American Producers Mentioned as Probable Members of Combination

A CHEMICAL entente embracing portions of the industry in the United States, Great Britain and Switzerland is an early probability, it is believed. This step is being taken to meet the "economic accord" being perfected between the German and the French industry, which is likely to be expanded to include Italy and Czechoslovakia.

The recent agreement among American, British and Swiss indigo producers is looked upon as the first step in the formation of the chemical entente. While indigo is but one chemical commodity, it occupies a key position in that it constitutes such a large proportion of the dye consumption of the Orient.

The value of association, if not the essentiality of it, has been demonstrated by the German cartel. The present cartel was organized in 1916, but its worth was so apparent in 1919 that the agreement was extended until 1999. Since 100 per cent of the German production is organized, it is the belief of students of the situation that similar action must be taken by the principal competing nations. The chemical and allied industries in the United States, Great Britain and Switzerland are adapted admirably to such an agreement, it is declared.

By organizing the industries of the three countries, it will be possible, it is predicted, to co-ordinate research and development work. The greatest need of the chemical industries in those three countries, it is said, is to eliminate waste of brain power. The number of chemists having marked creative ability naturally is limited in countries where chemical activities have been few. The way to meet most successfully the German-French competition, many believe, is for the three countries mentioned to co-ordinate their activities.

It also may be found advantageous to allocate distribution. The Reparations Commission has established that habit. An arrangement of that kind may be possible now, where it would not have been before the war.

A.S.M.E. Announces Plans for December Meeting

The forty-fourth annual meeting of the A.S.M.E., which will be held in New York Dec. 3 to 6 will be featured by two sessions of general interest and sixteen technical meetings. These are in addition to the usual presidential address, which this year will be followed by the ceremony at which the A.S.M.E. medals will be awarded to John R. Freeman, past president, A.S.M.E., and Frederick A. Halsey.

Some of the subjects to be discussed are: Heat Transfer for Fluids Flowing Inside Pipes; William H. McAdams and T. H. Frost; A Steam Loss Prevention Plan in a Textile Finishing Plant, Henry M. Burke; A Graphical Study of Journal Lubrication, H. A. S. Howarth; Factors in the Spontaneous Combustion of Coal, O. P. Hood; Economic Phases of Coal Storage, F. G. Tryon; Coal Handling and Coal Storage, H. E. Birch and H. V. Coes; High Pressure, Reheating and Regenerating for Steam Power Plants, C. F. Hirschfeld and F. O. Ellenwood; Reheating in Central Stations, W. J. Wohlenberg; Margins of Improvements in Central Station Steam Plant, E. L. Robinson; Boiler Plant Economics, N. E. Funk and F. C. Ralston; Economic Status of the Oil Engine, L. H. Morrison; Salt Velocity Method of Measuring Water, C. M. Allen and E. A. Taylor; The Gibson Method and Apparatus for Measuring the Flow of Water in Closed Conduits as Applied in Testing the Efficiencies of Water Wheels in Hydro-Electric Power Plants, N. R. Gibson.

Trade Notes

The National Plate Glass Co. has awarded a contract for a plate glass plant at Blairsville, which will will be in operation next summer.

A large quantity of paraffine wax stored at Genoa, Italy, was destroyed by fire on Oct. 19. The goods are said to have been owned by American interests.

The National Oil Products Co. has been granted a drawback by the Treasury Department on imported castor beans.

A German concern, Mee Yeh Handels Co. of Shanghai, is erecting a factory in that city, according to Trade Commissioner J. H. Nelson of Peking. The company will manufacture yeast and chemicals products.

Andrew M. Sherrill, president of the Welch, Holme & Clark Co., returned to business last week, after a prolonged illness.

The steamship "West Faraon" arrived at San Francisco Oct. 23, with 2,500 tons of Manila copra.

At the annual meeting of the Pennsylvania Salt Mfg. Co., George F. Baker was re-elected president. Other officers selected were Miers Bush, first vice-president; Edward E. Armstrong, vice-president and works manager; Charles M. Butterworth, vice-president and general sales agent; L. A. Smith, secretary and treasurer; Warren R. Over, assistant treasurer.

Fish Oil and Sulphur Will Not Make Tires!

British Columbia Court So Decides—Country People Victims of Scheme—$720,000 Involved

The case of the shareholders of the Gregory Tire & Rubber Co. vs. Morton Gregory, which has been occupying the attention of the Supreme Court of British Columbia for some time, was concluded recently by Justice Murphy bringing down a 15-page judgment against Morton Gregory, in which he ordered the defendant to refund to the company the $100,000 in cash and $620,000 in shares that had been paid to him for patents, covering a process for the manufacture of substitute-rubber tubes and tires, which Gregory averred would be equal or superior to genuine rubber, the substitute compound to be made from fish oil and sulphur by an electric process. The gist of the judgment may be found in the following extract from it:

"Reluctant as I am to find any man guilty of fraud, I am nevertheless forced to the conclusion on Gregory's own evidence that he had no such knowledge nor capacity to manufacture goods, and particularly automobile tires and tubes, with this compound, as he represented to the company."

A factory was built and equipped with elaborate machinery near Vancouver and Morton Gregory was given the management of it. As may be supposed, he failed to make good his promise to make rubber goods from fish oil and sulphur, and a year ago the company removed him from the management and placed others in charge.

Paint and Varnish Associations Elect Officers

Annual meetings of the National Paint, Oil and Varnish Association, the National Varnish Manufacturers' Association and the Paint Manufacturers' Association were held in Chicago during the week beginning Oct. 16.

Officers were elected for the ensuing year, as follows: National Paint, Oil and Varnish Association: President, Norris B. Gregg; vice-presidents, Southern Zone, George W. West, Atlanta, Ga.; Canada, F. J. Penberthy, Toronto; Western Zone, C. R. Root, Los Angeles; Central Zone, E. C. Currier, Sioux City; Eastern Zone, J. B. Lord, Boston; treasurer, D. W. Figgis, New York.

Newly elected officers of the Varnish Manufacturers' Association are: C. J. Roh, Newark, N. J., president; H. L. Calman, New York, first vice-president; L. V. Pulsifer, New York, second vice-president; George B. Heckel, Philadelphia, secretary.

Officers of the Paint Manufacturers' Association are: L. P. Moore, Brooklyn, president; Charles R. Cook, Kansas City, first vice-president; S. R. Matlack, Philadelphia, second vice-president; George B. Heckel, Philadelphia, secretary.

Trend of Opinion Against Pulpwood Embargo

Nova Scotia Interests Reported to Oppose Measure—Arguments Against Measure Heard—New Brunswick Hearings Follow

A general protest against the imposition of an embargo on the export of pulpwood, signed by more than 200 wood lot owners of Cape Breton Island, was the outstanding feature of one of the final sessions of the Nova Scotia and of the Canadian pulpwood investigation. The Royal Commission has now moved on into the Province of New Brunswick, where a number of sessions are to be held.

At the second day's sitting of the commission in Halifax, Hugh J. Chisholm, president of the Oxford Co., testified that there were many reasons why an embargo would not force the American mills to move to Nova Scotia. The port was closed 5 months in the year, and a plant making 300 tons a day of book paper could not operate under such conditions. There was absolutely no chance of securing the necessary water power; but if they had both a port and the power, other economic reasons would make it impossible to move the plant.

"If Canada goes to work and embargoes legitimate investments in the form of wood," said Mr. Chisholm, "foreign capital would think a long time before it would come here to make investments in the form of pulp or paper mills. I do not think any such company would come here after Canada had broken faith. They would say: 'If you embargoed wood, you would probably embargo pulp and paper also.'"

Strong opposition to the embargo was voiced by P. M. Jost, of the pulpwood exporting firm of the Jost Pulpwood Co., Montreal. Mr. Jost pointed out that the United States depends on Canada for only about one million cords out of its total consumption of five million on an average for the past 10 years. Ten years ago 67 per cent of the pulpwood produced in Canada was exported, and now 67 per cent is consumed at home. The witness said that in the natural course of events exports would tend to diminish and more mills would be established in Canada. The market for pulpwood today was poor and it had been hard to sell at a figure representing the normal cost of manufacture. If exports were restricted there would be no inducement to manufacture.

Rufus Dickie, manager of the Canadian Lumber Co., director of the Canada Lumbermen's Association and president of the Nova Scotia Lumbermen's Association, opposed an embargo, as the industry would develop fast enough without it. Nova Scotia, he said, was shut out from the upper Canadian market by the long haul, and the United States was the handiest market.

Dr. Becket Elected Perkin Medalist

At a meeting of the Perkin Medal Committee, held at the Chemists' Club, New York City, on Oct. 24, Dr. F. M. Becket, metallurgist and director of the Union Carbide & Carbon Research Laboratories, Inc., was unanimously elected to receive the 1923 Perkin Medal. The award will be made at the January, 1924, meeting of the American Section of the Society of Chemical Industry. Dr. Becket is widely known for his research in the field of electrometallurgy and for the production of a number of important metals and alloys. A list of patents granted to him and a few associates numbers sixty-three. His most noteworthy achievement was the discovery and development of the process for reducing ores by silicon, which is ranked with the aluminothermic process of reduction of Goldschmidt. Dr. Becket was the first producer of ferrovanadium on a commercial scale and perhaps the earliest producer of molybdenum by direct smelting methods. During the war he developed for the government the process for the production of zirconium.

F.A.E.S. Coal Storage Committee to Report Soon

Results of far-reaching economic and social importance are likely to be attained by the nation-wide study of the storage of coal now in progress by nearly 100 committees of the Federated American Engineering Societies, it is disclosed in a progress report to the executive board of the Federation by Dean Perley F. Walker of the University of Kansas.

Dean Walker, who is directing the field work of the investigation, in which over 500 engineers are engaged, said that the final report would be ready about Jan. 1, 1924, and would place at the disposal of the nation the most authoritative information obtainable as to the engineering, chemical and economic factors involved in the storage of coal.

Dr. John Allen Harker Dead

The forces engaged in the attempt to solve nitrogen and oxygen problems have suffered a serve loss in the death of Dr. John Allen Harker. Dr. Harker's death is announced in advices just received from London. It will be recalled that Dr. Harker visited the United States during the war in connection with the matter of nitrogen supply. He organized the nitrogen products committee of the British Ministry of Munitions.

Dr. Harker was born in 1870. He was Dolton's scholar in chemistry at Owens College in 1891.

Vertical Retort Plant Planned

A new plant of Woodhall-Duckam vertical gas retorts is planned by the Iroquois Gas Co., of Buffalo. The retorts will be equipped so that they can be fired either with retort coal gas or with producer gas generated in outside producers. Thus the variation in output will be from about 2,500,000 cu.ft. to 4,500,000 cu.ft. without changing the rate of carbonization, simply changing from all surplus to part surplus gas.

The plans for this plant are part of a general development scheme for gas supply in and about Buffalo by the newly organized consolidated company which takes in both natural gas and manufactured gas operations of that community. T. R. Weymouth, formerly of Oil City, Pa., is president and general manager of the properties.

The company has already consolidated the distribution systems to the point that only a single gas supply is delivered. This gas is a mixture of manufactured and natural gas. The gas from the new vertical retort installation will be added to the mixture in order to give adequate production capacity for the heavy load season.

Increases Gelatine Output

Gelatine products from seaweed are to be produced on a much larger scale than at present by the American Agar Co. of Glendale and San Diego, Calif. Equipment for a factory at San Diego, having an initial production ten times as great as the company's present factory, is being secured as rapidly as possible; and the new unit should be in operation by the first of the year. Work to date at the Glendale plant has shown the practicability of a large number of hitherto undeveloped uses for agar gelatine, including the manufacture of a non-flammable photographic film. John Becker, well known throughout southern California for his work on citric acid, oils and other fruit products, is the company's chemical engineer.

Alcohol

There was a general reduction in prices for methanol, reflecting increased offerings from producing centers. In revising prices first hands cut the list 5c. per gal., establishing the market for the 95 per cent grade at 88c. per gal. in drums and 93c. per gal. in bbl., carload lots. The 97 per cent grade settled at 90c. per gal. in drums and 95c. per gal. in bbl. The pure closed at 90c. per gal., tank cars, works. No further changes occurred in the market for denatured alcohol, the market holding firm at the recent advance. The formula No. 1, special, in drums, carload lots, was maintained at 41½c. per gal., with the 6c. premium obtaining for cooperage. On the 188 proof, completely denatured, formula No. 1, 41½c. was asked, drums included. Ethyl spirits, U.S.P. 190 proof, held at $4.75 per gal., cooperage basis.

Market Conditions

Chemicals Move to Lower Average Price Levels in Week's Trading

Influence of Caustic Soda, Soda Ash, Bleaching Powder and Methanol Felt in Reducing Values—Business Gradually Expanding

THERE is a slow but gradual improvement to trading in chemicals and allied products. This results from greater activity in consuming trades and from the reduction of manufactured stocks which were carried into the fall season. Some industries are still backward and are not in a position to take their normal quotas of chemicals and raw materials. The soap trade was reported to be taking on stocks more freely during the past week.

The tanning industry is still backward. A report from Boston states that conditions and policies in the long demoralized tanning industry—one of the first to feel "deflation," and yet to recover—are clearly if quietly and gradually now at work that give distinct promise of a thorough and much needed trade reform. Already some parts of the tanning business have made scattered efforts toward self-betterment, notably the sole leather tanners. The report further states that still more comprehensive, collective and continued efforts are necessary if a basic but ill-co-ordinated industry is again to find itself. The cumulative effect of long endured conditions has created an atmosphere favorable to such endeavor and definite moves are afoot to see that it becomes a reality.

The weighted index number for the week shows a loss as compared with the preceding week. In some instances lower prices have been established by competitive selling and, in the case of bleaching powder, current quotations are below producing costs, which condition must be regarded as temporary. Different other items are selling at relatively low levels when replacement costs are taken into consideration. Many important chemicals, however, have been readjusted downward because circumstances permitted such revisions and the establishment of lower valuations was regarded as conducive to larger consumption.

New contract prices for soda ash and caustic soda went into effect last Monday. This announcement attracted wide attention because the newly named prices represented a decline which many had not anticipated. Furthermore these two chemicals had found a steady outlet in consuming trades throughout the year and had been practically free from competitive selling. Export demand, however, had fallen off and quotations f.a.s. New York, especially for caustic soda, had been under the figures named for home buyers. The lowering in prices, therefore, was largely an equalization of domestic and export prices so as to give the home trade the benefit of the lowest prices and at the same time continue the effort to hold our normal trade in those materials with foreign markets.

Methanol Prices Reduced — Caustic Soda and Soda Ash Contract Prices Lowered — Jobbing Prices Also Down—Prussiate of Soda Easier—Bleaching Powder Quiet at Recent Reduction—Arsenic Steadily Advancing — Bichromate of Soda Irregular.

With the active consuming season passed, arsenic has continued to hold a place of prominence in the market. Producing countries abroad have offered only in a small way for forward deliveries and domestic output has been greatly curtailed. In view of the indicated large consumption next year, this leads to the view that supplies will be inadequate and this opinion is stimulating speculative and consuming inquiries with a correspondingly strengthening effect on values.

Acids

Acetic Acid—The position of raw materials is said by some to be less steady but this view seems based on expectation that declines may follow rather than on actual changes in selling prices as holders quote the materials market as steady and unchanged. Demand for acid is increasing and prices are not subject to the degree of shading which was current a short time ago. Quotations are $3.38@$3.63 per 100 lb. for 28 per cent; $6.78@$7.13 per 100 lb. for 56 per cent; $9.58@$9.83 per 100 lb. for 80 per cent; $12@$12.78 per 100 lb. for glacial. Imported glacial is offered at the inside figure, with domestic ranging upward according to seller and quantity.

Citric Acid—Foreign material reached the local market during the week and with demand slow the tone of prices continues easy. Domestic grades are quoted at 49@50c. per lb. and these prices are said to be very close to production cost. Imported is offered at 48@49c. per lb.

Muriatic Acid—Withdrawals against old orders are taking large amounts to the consuming trades. New business likewise is gaining in volume and the market is working into a more stable position with sellers inclined to hold out for full quotation prices. Quotations are continued at 90c.@$1 per 100 lb. for 18 deg.; $1@$1.10 per cwt. for 20 deg.; and $1.75@$1.85 per cwt. for 22 deg.

Oxalic Acid—Rather heavy arrivals have reached the market in the interval, coming from European points. The position of the imported material, however, has undergone no change and holders continue to ask 12c. per lb. for spot goods. Domestic acid is offered at 11¾c. per lb. at works, so freight rates play an important part in present competition.

Nitric Acid—Surplus stocks are being worked off but holdings are still large and prevent any real firmness in prices. Consuming trades are not buying heavily but are increasing their demands and the market has improved materially in the past few weeks. Asking prices are $4.50@$4.75 per 100 lb. for 36 deg.; $5@$5.25 per 100 lb. for 40 deg.; and $5.25@$5.50 per 100 lb. for 42 deg.

Tartaric Acid—Buying interest has not been keen enough to give any strength to the market and prices remain easy. Imported grades of tartaric are to be had at 30½@31c. per lb. Domestic makers hold their prices at 34½c. per lb. but might grant concessions on firm bids from consumers.

Potashes

Bichromate of Potashes—While there is keen competition among sellers the prices quoted for prompt and nearby shipments show an inside of 9½c. per lb. with some producers asking 9⅝@9¾c. per lb. according to quantity. The latter range also is given as the contract price for later positions and the position of sellers in asking a premium for later deliveries is regarded as expressing their belief that values are at their lowest levels in the spot market.

Caustic Potash—There has been an attempt on the part of some importers to advance the price of foreign caustic but enough offerings have been on the market at 7c. per lb. to hold that figure as the representative price for fair sized lots. Developments abroad had no influence during the week but many hold that shipments will command higher

prices and ultimately force a revision of prices. Domestic caustic is quoted at 7¼c. per lb. at works with smaller lots bringing a premium.

Permanganate of Potash — Nearby shipments from abroad were offered at 17½c. per lb. and this has taken the edge off the spot market. Demand for spot goods was quiet and holders of stocks were more eager to meet buyers' views. In some quarters 18½c. per lb. was held as the asking price but 18c. per lb. could be done without difficulty and possibly might be shaded. Domestic permanganate is still quoted at 17@17½c. per lb. f.o.b. works.

Prussiate of Potash—There is very little interest in red prussiate of potash and quotations are largely nominal at 60@65c. per lb. according to holder. Yellow prussiate is moving in a moderate way with shipments unsteady in price. The quotation for prompt from abroad is 27½c. per lb. but this is not regarded as firm and probably could be shaded materially on a firm bid. Spot holdings are unchanged at 28c. per lb.

Sodas

Soda Ash—Leading factors in the trade have announced contract prices for 1924 deliveries. The latter are in buyers' favor, as they are lower than the prices which have prevailed in recent months. The new schedule of prices effective on Oct. 22 quotes light ash 58 per cent at $1.25 per 100 lb. in bulk; $1.38 per 100 lb. in bags; and $1.63 per 100 lb. in bbl. Dense ash 58 per cent is quoted at $1.35 per 100 lb. in bulk; $1.45 per 100 lb. in bags; and $1.69 per 100 lb. in bbl. Above quotations refer to carlots f.o.b. works. Jobbing quotations also have been lowered and on less than carlot deliveries light ash 58 per cent is offered at $2.44 per 100 lb. in bbl. and $2.19 per 100 lb. in bags, in lots of from 1 to 4 packages. For 5 packages or more the new prices are $2.29 per 100 lb. in bbl. and $2.04 per 100 lb. in bags. These prices are delivered in the New York district and allowance of 10c. per 100 lb. is given where goods are taken from warehouse by the buyer.

Bichromate of Soda—Prices for bichromate are unsettled due to the fact that different quotations are given by different factors in the trade. On round lots the asking price f.o.b. producing points ranges from 7¼c. to 7⅜c. per lb. The inside figure is far from general and most sellers will not do better than 7⅜c. per lb. and at the latter figure will accept orders covering deliveries into distant periods. Demand is still reported to be quiet, as large consumers are not working at anything like normal capacities.

Caustic Soda—The feature of this market was an announcement of a reduction in prices on contracts. The decline in price was made at the close of the preceding week and went into effect as of Oct. 22. The prices apply to contracts in carlot quantities and cover deliveries through 1924. The schedule is as follows: Solid caustic soda 76 per cent in standard drums $3.10 per 100 lb.; ground, flake and powdered 76 per cent, in standard drums $3.50 per 100 lb.; solid 74 per cent in standard drums $3.02 per 100 lb. These prices are f.o.b. works. Jobbing prices quickly followed the lead of the carlot schedule and on less than carlot quantities revised quotations are $3.91 for 100 lb. for solid 76 per cent in lots of from 1 to 4 drums and $3.76 per 100 lb. in lots of 5 drums and upward. Ground or flake in drums is quoted at $4.31 per 100 lb. in lots of 1 to 4 drums and at $4.16 per 100 lb. in lots of 5 drums and upward. Ground or flake 76 per cent in bbl. is held at $4.56 per 100 lb. in lots of 1 to 4 bbl. and $4.41 per 100 lb. in lots of 5 bbl. and upward. These jobbing prices apply to deliveries in the Metropolitan district with allowance of 10c. per 100 lb. for cartage if buyer takes delivery direct from warehouse.

Many members of the trade had thought lower prices improbable and in view of the fact that domestic consumption was reported to be heavy especially when compared with the movement of other chemicals it was held that a reduction in price would not have the effect of expanding home consumption. The fact, however, that f.a.s. quotations were under those quoted to domestic buyers caused some dissatisfaction and the revision of contract prices merely brought them into line with the values prevailing in the export trade.

"Chem. & Met." Weighted Index of Chemical Prices

Base = for 1913-14

This week	**165.09**
Last week	165.99
Oct., 1922	152.00
Oct., 1921	151.00
Oct., 1920	263.00
Oct., 1919	233.00
Oct., 1918	280.00

There was an advance in crude cottonseed oil; but lower prices obtained for methanol, copper sulphate, formaldehyde, caustic soda, soda ash and linseed oil and the week's index number went off to the extent of 90 points.

Prussiate of Soda—The quotation for domestic prussiate has been lowered to 13½c. per lb. for November deliveries. This is a decline of ½c. per lb. from the price asked for October goods. Imported prussiate is irregular in price as spot offerings are subject to private terms and as low as 13¼c. per lb. is said to have been done. Shipments also are offered at 13¼c. per lb. but there is not much trading in anything but spot.

Miscellaneous Materials

Arsenic—Imports of aısenic in September were 1,480,482 lb., which makes total importations for the first 9 months of the year 15,374,384 lb. Stocks of arsenic in the spot marget for the past month have been small, which would indicate that September arrivals went largely into consumption. Arsenic was one of the interesting items of the market last week. Buying orders are increasing and small supplies promised for the future are adding speculative interest. Either stocks held in the local market are small or they are in strong hands, as difficulty was found in filling orders calling for fair sized lots. Prices are responding to the increase in demand and sales have been put through at varying prices. Early in the week goods changed hands at 12½c. per lb. On Thursday 13c. per lb. was paid and later in the day there were unfilled orders at 13⅝c. per lb. and 13¾c. per lb. was asked. Futures were difficult to place at any fixed price. Some domestic producers were quoting 12c. per lb. for round lots to consumers. Importers were finding difficulty in securing offerings from foreign producing countries. There is much uncertainty about the amount of arsenic which outside countries will have to offer and production at home is not coming up to expectations. It is quite evident that the home output for the second 6 months of the year will fall far short of earlier estimates.

Bleaching Powder — Only moderate buying has followed the recent cut in prices and the fact that asking prices are lower than producing costs would warrant is proving no stimulant. While unsold stocks undoubtedly have been reduced, enough material is thought to be held by sellers to keep values weak so long as these stocks are pressed for sale. Export figures show that bleach was shipped out of the country in larger amounts in September than was the case in August. Fair export demand was reported in recent weeks. Demand for home consumption is far below normal due to slowness in the paper trade, which is the largest consumer of bleach. October deliveries to contract holders are quoted at $1.25 per 100 lb. and November and December deliveries at $1.50 per 100 lb. Contracts for deliveries over all of next year are offered at $1.50 per 100 lb. for standard drums in carlots, f.o.b. works.

Copper Sulphate — Fair call is reported for domestic grades and asking prices range from 4.80c. to 5c. per lb. for large crystals. Imported offerings on spot were offered at 4¾c. per lb.. but this price is more or less nominal. Shipments were quoted at 4.40c. per lb.

Formaldehyde—The easy tone which has characterized the market has caused first hands generally to come out with open quotations of 11½c. per lb. Demand is slow and with offerings reported to be fairly large, indications do not point to any immediate recovery in values.

Ethyl Acetate—A steady undertone featured the market and leading makers continue to quote 92@95c. per gal. on the 85 per cent material, in drums, the inside figure prevailing on carload lots. On the 99 per cent material prices ranged from $1.05@$1.10 per gal., as to quantity.

Coal-Tar Products

Crudes in Ample Supply and Prices Unsettled—Solvent Naphtha Available at 23c. Works

THE recent readjustment in prices for the different crudes did not help matters much in the market for coal-tar products, for operators again reported business as rather slow. Offerings have been increasing and the larger consumers believe that enough material will be available for some time to come to prevent a general upturn in prices. At the close the undertone was barely steady, especially in benzene, toluene, solvent naphtha and xylene. Most traders continued to ask from 25@27c. per gal. on water-white solvent naphtha, but it was reported that one of the larger producers has been taking on business at 23c., tank car basis, f.o.b. point of production.

Offerings of 90 per cent benzene at 21c. per gal., tanks, works, were numerous, yet some traders took the stand that further reductions seem improbable, at least so far as the near future is concerned. Production, on the other hand, has been stimulated somewhat by the unfavorable outlook for the motor grades, and supplies appear more than ample for current needs. Export call has been quiet. Cresylic acid was irregular in price.

Some contract business in naphthalene flake has been worked at 6c. per lb. The importations of crude naphthalene have been large and, with no important change in any of the foreign markets, the undertone in most directions favored buyers. Phenol was offered rather freely, but at unchanged prices. The call for salicylates was fair and first hands were inclined to take a firmer view of the situation. There were offerings of toluene at 24c. in tanks and 29c. in drums, carload lots, f.o b. works. Several shipments of pyridine arrived at New York from foreign ports.

Aniline Oil—Scattered lots sold for prompt shipment at 16c. per lb., drums. The market was steady so far as producers were concerned.

Aniline Salt—There were offerings on spot at 23@23½c. per lb., with the market barely steady.

Benzene—Producers offered 90 per cent benzene for immediate shipment from works at 21c. per gal., tank car basis. Demand was moderate only. Competition for business pending was keen and it was rumored that scattered lots could have been picked up through outside sources at slight concessions. However, in several directions it was thought that prices are near bottom for the movement. Consumers refused to contract far ahead under prevailing conditions. Unless a radical change occurs in the motor fuel situation buyers look for prices to show continued irregularity.

Cresylic Acid—Prices named covered a wide range, depending on color, delivery, etc. Business was inactive, but traders feel that demand should soon pick up, and for this reason the undertone appears to be a shade firmer. On some special quality material first hands quote 85@90c. per gal., immediate shipment, the price depending on quantity. Ordinary acid for immediate shipment could have been secured at 70@80c. per gal., the inside figure obtaining on the 95 per cent grade.

Naphthalene — Large producers of flake have been taking on some contract business on the basis of 6c. per lb., in bbl.; on ball the market held around 6¾@7c. per lb., depending upon the seller. Chips closed nominally at 5@5¼c. per lb., carload lots, works. Crude for shipment from abroad was unchanged at 2¼@2½c. per lb., c.i.f. New York, the price depending upon the quality.

Phenol — Open prices for U.S.P. phenol underwent no change. Demand was not up to expectations and keen competition unsettled the market in more than one direction. Leading producers held out for 26c. per lb., in drums, immediate shipment, with a possibility of shading this figure on round lots, nearby delivery.

Paranitraniline—Demand was along routine lines only and prices were irregular. Producers quote 72@75c. per lb., as to quantity. Second hands offered scattered lots at slight concessions.

Pyridine—Several shipments arrived from abroad, but this material did not come on the market and prices for spot goods remained wholly nominal. For spot pyridine some holders were asking close to $6 per gal. On futures the market settled at $4@$4.50 per gal., as to position.

Solvent Naphtha—Trading in water white solvent naphtha was reported at 23c. per gal., tank cars, f.o.b. works. Rubber manufacturers have not been inquiring so freely of late and this has eased the situation to some extent. At the close it was possible to obtain the water white material for shipment at 23c., tanks, works, and the crude at 20c. per gal.

Toluene — Producers offered toluene for shipment from point of production on the carload basis of 24c. per gal., in tanks, and 29c. per gal., in drums.

Match Company to Issue Bonds

American bankers are negotiating with the International Match Corporation, a holding company incorporated in Delaware, most of the stock of which is owned by the Swedish Match Co., for an issue of about $15,000,000 bonds. Proceeds will be used for acquisition of properties in North and South America outside the United States.

Paint and Varnish Industries Quiet in Germany

In a report from Frankfort-on-Main, Consul-General Dumont says that the improvement in the German paint and varnish industry in the early part of the year proved to be of short duration. The further depreciation of the mark and the consequent high prices of foreign oils and resins drove prices up beyond the buying power of consumers and a heavy falling off of sales resulted.

Synthetic products are produced on an increasing scale. The use of shellac has fallen off, products based on synthetic resin being used to a great extent in its place. The polish and hardness of the latter are said to compare favorably with those of shellac. It is stated that for this reason the market for shellac in Germany will continue poor, even though conditions in foreign trade improve. Sales of synthetic varnish are steadily increasing.

Rust-proof paints, with no admixture of linseed oil, are also widely offered. The constituents are said not to be based on the use of coal-tar oils as substitutes for linseed oil.

The actual capital of manufacturers of paints and varnishes has decreased by more than 50 per cent, and they are not in a position to wage any kind of "Save the Surface" campaign. Besides curtailing their imports and being unable to cover costs in their selling prices, they must at the same time deal with the problems of reorganization and amalgamation which follow the invention and increasing use of synthetic products. They are facing a situation more unfavorable than at any time since the war.

Lower Output of Turpentine and Rosin

According to preliminary figures of the Department of Commerce, the output of turpentine and rosin from crude gum for the producing season ended March 31, 1923, by 1,219 establishments was 22,394,137 gal. of turpentine and 1,499,538 bbl. (500 lb. each) of rosin. The production of these commodities during 1922 by wood-distillation plants was 1,858,698 gal. of turpentine and 152,257 bbl. of rosin.

The statistics indicate decreases when compared with the figures for the previous year of 8 per cent in the production of turpentine and 9.8 per cent in the production of rosin from crude gum. Increases, however, are shown in the production of turpentine and rosin by wood distillation, bringing the output by the distillation method practically up to the level reached in 1920.

Turpentine stocks on hand March 31, 1923, at the stills and in the hands of consumers show considerable decreases when compared with the quantities on hand a year earlier, while the stocks at wood distillation plants and at ports and distributing points increased. Rosin stocks in the hands of consumers and at wood distillation plants increased but the stocks at ports decreased.

Vegetable Oils and Fats

Nearby Cottonseed Strong—Linseed Declines—Active Demand for Menhaden Oil and Tallow

SOAP makers were buyers of tallow and crude menhaden oil on a liberal scale. Producers of lard compound paid higher prices for crude cottonseed oil, immediate and nearby shipment from the South. There was improvement in the demand for palm oils, but the situation in coconut oil underwent little if any change. China wood oil held steady, while lower prices obtained for linseed oil, all positions.

Cottonseed Oil—With the movement of crude oil not up to expectations, and crop developments unfavorable, the market established new highs for the movement. Aside from the strength in crude the speculative market for the refined product witnessed a squeeze in the October option. Interest now centers in November refined oil, but the speculative element was not disposed to bull this position so strongly. The Department of Agriculture will issue a revised estimate on the condition of the cotton crop as of October 25, and most traders look for another reduction in the yield. Private estimates now place the crop at 10,000,000 to 10,300,000 bales. The seed coming to market is poor. Crude sold at 9½c., tanks, November shipment from mills. Cash demand for winter oil was fair and business was reported at 13¼@13¾c. per lb., in bbl. Prime summer yellow on spot settled around 13@13¼c. per lb. Lard compound was firm at 13¼@13¾c. per lb., as to brand. Exports of cottonseed oil for the month of September amounted to 1,400,000 lb., which compares with 3,638,000 lb. a year ago. Exports for the 9 months ending with September 30 amounted to 33,253,000 lb., comparing with 46,384,000 lb. for the corresponding period a year ago.

Linseed Oil—Crushers generally regarded the estimated yield on the 1923-24 Argentine crop of flaxseed as too high. Private estimates on the probable yield ranged from 60,000,000 to 67,000,000 bu. Consumers regarded the outlook for obtaining cheaper oil as exceptionally favorable and the demand for futures met with a severe setback. It develops that quite a little business in prompt oil was booked just before the close of the previous week, and much of this buying was attributed to covering by a crusher short of seed. New crop Argentine seed was offered more freely, January shipment being available at $1.90 per bu., c.i.f. New York, with February at $1.82 per bu. With seed at these prices crushers were able to offer February forward oil at 84c. per gal., cooperage basis, but buyers could not be interested. One crusher offered December-April at 85c. November was traded in at 88c. per gal. Spot oil declined to 92c. per gal., cooperage basis.

China Wood Oil—News on the political situation in China was less encouraging and this had a tendency to steady the shipment market. Prices, however, underwent little change as demand showed no improvement. Spot oil settled at 21@21½c. per lb., as to seller. October-December shipment from the coast was available at 20c. per lb., tank car basis.

Coconut Oil—The coast market was irregular, several cars of domestic Ceylon type oil selling at 8c. per lb., October-November shipment. It was reported that December-April was offered at 8c., Pacific coast basis, sellers' tanks. Manila oil in bulk was offered in New York at 8½c. per lb., nearby delivery, but the tank car quotation held at 8⅝@8¾c. per lb. Copra sold at 4⅝c. per lb., Cebu sundried, c.i.f. coast.

Sentiment on the future course of prices for linseed oil turned bearish as soon as the first official estimate on production of flaxseed in the Argentine was made public. Offerings of February-March-April oil at 84c. per gal., carload lots, cooperage included, were reported, which compares with 88c. a week ago. Argentine flaxseed crop statistics for the past 5 years, the 1923-24 figures being subject to change as the season progresses, follow:

	Acreage	Yield, Bu.
1923-24	5,253,000	77,200,000
1922-23	4,048,000	53,000,000
1921-22	3,892,000	32,923,000
1920-21	3,484,000	50,470,000
1919-20	3,522,000	42,038,000

Corn Oil—Crude oil sold at 9¼c. per lb., tanks, f.o.b. point of production. Late in the week bids at this figure were turned down. Crude in cooperage was offered at 11¼c., New York.

Palm Oils — Demand improved and closing prices were steady. Lagos settled at 7.60c. per lb., with softs at 7.45c. and Niger at 7.20c., c.i.f. New York.

Rapeseed Oil—Resale offerings of refined rapeseed oil on spot sold at 72@74c. per gal. On futures asking prices held at 74@76c. per gal., as to position.

Soya Bean Oil—Spot oil, crude sellers' tanks, duty paid, sold at 9¼c., New York. Later the market steadied and prices were wholly nominal. On new crop offerings 7c. was asked, c.i.f. New York, bulk basis.

Menhaden Oil—A soap maker took on between 12,000 and 15,000 bbl. of crude menhaden oil, cleaning up most of the offerings. The transactions included oil held in Florida and Texas. The average price paid was 47½c. per gal., tank cars, fish factory. Fishing last week was poor.

Tallow, Etc. — Soap makers were active buyers of city special tallow and it was reported that more than 1,500,000 lb. sold on the basis of 7¾c. per lb., ex plant. Extra special sold at 7⅞c. per lb., ex plant. Yellow grease was firmer at 6⅝@6⅞c. per lb., according to acidity. Oleo stearine was offered at 12¼c. New York, and 11¾c. Chicago.

Miscellaneous Materials

Antimony — The offerings were reduced on reports from China to the effect that political troubles were affecting the supply. Chinese and Japanese brands on spot advanced to 8c. per lb.

Blanc Fixe—Demand was moderate, but prices for the dry held at 4@4½c. per lb., in bbl., carlots, prompt shipment from works.

Glycerine—Inquiry was slow. Chemically pure, carload lots, in drums, was offered at 17c. per lb., with a possibility of shading this figure on a bid. Dynamite glycerine was offered at 16½c. per lb., carload lots, with buyers at 16¼c. per lb. Crude soap-lye, basis 80 per cent, loose, held at 10¾@11c. per lb., f.o.b. point of production. Saponification, basis 88 per cent, loose, settled at 12¼@12½c. per lb., carload lots.

Lithopone—First hands continued to quote the market steady at 7@7¼c. lb., in bags, carload lots, prompt and nearby shipments.

Naval Stores—Spirits of turpentine was lowered to 99c. per gal., a decline of 2c. for the week. Primary markets were easier on lack of important buying, either for domestic for foreign account. Rosins were quotably unchanged, the lower grades holding on the basis of $5.80 per bbl.

Shellac — The market was a quiet affair and increased spot offerings resulted in another slight reduction in prices. T. N. was available at 60@61c. per lb. Bleached, bone dry, closed at 72@73c. per lb.

Waxes — Domestic call for paraffine was good and prices ruled steady on the basis of 2⅞@3⅛c. per lb. for crude scale, carload lots, according to melting point. Exports of paraffine wax in September officially were placed at 22,283,000 lb., against 24,014,000 lb. in September a year ago.

White Lead—With no change in the position of the metal, corroders maintained prices for lead pigments on the old basis of 9¾c. per lb. for dry white lead, basic carbonate, in casks, carload lots. Withdrawals against contracts have been up to normal and there has been no excessive accumulation in supplies.

Zinc Oxide — Nothing occurred to change the outlook. Demand from the larger consumers has not appeared in volume and with an easier situation in the metal the market presented a barely steady undertone. Producers quote 8c. on American process, lead free, and 7@7¼c. on the leaded grades. French process oxide, red seal, held at 9⅞c. per lb.

Imports at the Port of New York

October 19 to October 25

ACETIC ANHYDRIDE—9 cs., Rotterdam, R. W. Greeff & Co.

ACIDS—Cresylic—10 dr., Liverpool, Order. **Formic**—56 cs., Rotterdam, R. W. Greeff & Co.; 32 carbags, Hamburg, International Acceptance Bank. **Oxalic** — 27 csk., Hamburg, Innis, Speiden & Co.; 40 bbl. and 40 csk., Hamburg, Order. **Phenol**—2 cs., Liverpool, Order. **Stearic**—20 cs., Rotterdam, Parsons Plymouth Organic Laboratory. **Tartaric**—268 csk., Rotterdam, Order.

ALCOHOL — 10 dr. butyl, Havre, De Mattia Chemical Co.

ALIZARINE PASTE — 20 csk., Rotterdam, Grasselli Chemical Co.

AMMONIUM CARBONATE — 10 csk., Liverpool, Brown Bros. & Co.; 20 csk., Liverpool, Farmers Loan & Trust Co.

AMMONIUM PERCHLORATE—74 bbl. and 895 cs., Genoa, New York Trust Co.

ANTIMONY—83 csk., London, E. Hill's Sons Co.; 150 bbl. red, Havre, Heemsoth, Basse & Co.

ANTHRACENE—1 cs., Rotterdam, Lunham & Moore.

ANTIMONY SULPHIDE—5 csk., Southampton, L. H. Butcher & Co.; 1,092 bg., Antofagasta, Watson, Geach & Co.; 7 csk., London, Order.

AMYLACETATE — 2 csk., Hamburg, Order.

AMMONIUM NITRATE — 2,202 csk., Hamburg, Kuttroff, Pickhardt & Co.

ALUMINA HYDRATE—75 bbl., Hamburg, A. Hurst & Co.

ARSENIC—123 bbl., Tampico, American Smelting & Refining Co.; 91 bbl., Tampico American Metal Co.; 100 csk. red, Hamburg, A. Klipstein & Co.; 200 csk., Hamburg, Ore & Chemicals Corp.

BARYTES—1 lot (quantity not specified), Bremen, Ore & Chemicals Corp.; 200 bg., Bremen, L. H. Butcher & Co.; 1,000,000 kilos, Bremen, Ore & Chemicals Corp.; 200 bg., Bremen, New York Trust Co.; 1 lot (bulk), Bremen, Ore & Chemicals Corp.; 299 bg., Bremen, Order; 1,000 bg., Genoa, Bankers Trust Co.

BRONZE POWDER — 17 cs., Bremen, Hensel, Bruckmann & Lorbacher; 19 cs., Bremen, B. F. Drakenfeld & Co.

CALCIUM CYANIDE—9,390 dr., Hamburg, Guaranty Trust Co.

CHALK—200 bg., Antwerp, C. B. Chrystal & Co.; 500 bg., Antwerp, Reichard-Coulston, Inc.; 1,340,000 kilos (bulk), Dunkirk, Taintor Trading Co.

CHINA CLAY—1,052 tons, 58 csk. and 293 bg., Fowey, Order.

CHEMICALS—35 pkg., Bremen, Pfaltz & Bauer; 560 bg., Glasgow, Coal & Iron Nat'l. Bank; 500 bg., Glasgow, Brown Bros. & Co.; 180 csk., Rotterdam, Stanley Daggett, Inc.; 50 csk., Rotterdam, Hummel & Robinson; 14 csk. aniline, Rotterdam, Grasselli Chemical Co.; 100 csk., Rotterdam, Order; 20 csk., Hamburg, P. Uhlich & Co.; 22 cs., Hamburg, Eimer & Amend; 65 dr., London, Peroxide Chemical Co.; 100 csk., Hamburg, International Acceptance Bank.

CHROME ORE—391 tons, Beira, Asia Banking Corp.

COAL-TAR DISTILLATE — 106 dr., Liverpool, Order; 110 dr., Liverpool, Monsanto Chemical Works; 38 dr., Liverpool, Order.

COLORS—200 bg. earth, Genoa, Reichard-Coulston, Inc.; 520 bg., Genoa, Mechanics & Metals National Bank; 14 csk. aniline, Havre, Ciba Co.; 5 cs. do., Havre, Ackerman Color Co.; 5 csk., Havre, B. Bernard; 3 cs., Havre, Pennrich & Co.; 5 csk., Havre, Order; 52 csk., Rotterdam, Textile Alliance, Inc.; 2 csk., Rotterdam, H. A. Metz & Co.; 2 csk., Rotterdam, Kuttroff, Pickhardt & Co.; 2 bbl. aniline, Genoa, Irving Bank-Col. Trust Co.; 3 csk., Hamburg, Carbic Color & Chem. Co.; 18 pkg. aniline, Hamburg, Kuttroff, Pickhardt & Co.; 10 csk. aniline, Hamburg, Ciba Co.

CREAM TARTAR—100 keg, Marseilles, Order.

DIVI-DIVI—260 bg., Monte Christy, E. Pavenstedt & Co.

DYESTUFFS—4 csk., London, Equitable Trust Co.

EPSOM SALT—500 bg., Bremen, E. Suter & Co.; 250 bg., Hamburg, A. Klipstein & Co.

FUSEL OIL—2 dr., Dunkirk, Order; 9 dr., Rotterdam, Order; 8 dr., Rotterdam, New York Trust Co.; 18 csk., Rotterdam, A. Klipstein & Co.; 17 bbl., Hamburg, Continental Shipping Corp.; 28 bbl., Hamburg, Order.

GRAPHITE — 300 csk. and 6,750 bg., Calcutta, Order.

GUMS—220 bg. copal, Antwerp, Brown Bros. & Co.; 57 cs. tragacanth, London, Order; 1,741 sk. copal, Matadi, L. C. Gillespie & Sons; 20 bg. tragacanth, London, Order; 10 cs. tragacanth, London, Anderson-Hillier Co.; 38 cs. tragacanth, Constantinople, C. Patrikiades Sons; 1,593 bg. copal, Matadi, L. C. Gillespie & Sons.

IRON OXIDE — 4 csk., Liverpool, Reichard-Coulston, Inc.; 44 csk., Liverpool, C. B. Chrystal & Co.; 78 csk., Liverpool, J. A. McNulty & Co.; 20 csk., Liverpool, J. H. Rhodes & Co.; 27 csk., Liverpool, L. H. Butcher & Co.

LAMP BLACK—50 csk., Antwerp, L. H. Butcher & Co.

LITHOPONE—60 csk., Bremen, Order.

LOGWOOD EXTRACT—130 csk., Kingston, West India Chemical Works.

MAGNESITE — 250 bg., Rotterdam, Speiden-Whitfield Co.; 142 bg., Rotterdam, A. Kramer & Co.

MAGNESIUM CHLORIDE — 600 dr., Hamburg, Innis, Speiden & Co.; 4 cs., Hamburg, Order; 475 dr., Hamburg, Brown Bros. & Co.

MANGANESE—99 cs., Marseilles, Order.

NAPHTHALENE — 78 bbl., Glasgow, E. M. Sergeant & Co.; 490 bg., Rotterdam, Lunham & Moore; 503 double bg., Rotterdam, Lunham & Moore.

NITROGENOUS MATERIAL—1,502,405 kilos (bulk), Rotterdam, Peters, White & Co.

OCHER—62 bbl., Havre, H. A. Cambere; 96 csk., Marseilles, Reichard-Coulston, Inc.

OILS—China wood—150 csk., London, Order; 118 bbl., London, Irving Bank-Col. Trust Co. **Cod**—200 csk., St. Johns, National Oil Products Co.; 50 csk., St. Johns, Cook & Swan Co.; 100 csk., St. Johns, Order. **Olive** (Sulphur Oil)—75 bbl., Genoa, Order. **Palm**—1,770 csk., Burutu, Irving Bank-Col. Trust Co.; 1,223 dr., Matadi, Niger Co. **Sesame**—58 cs., Genoa, Order.

PHOSPHORUS—56 cs., Hamburg, C. W. Campbell.

POTASSIUM SALTS—72 cs. perchlorate, Antwerp, Hummel & Robinson; 1,000 bg. nitrate, Antwerp, Order; 28 csk. carbonate, Bremen, P. H. Petry Co.; 1,000 bbl. chlorate, Hamburg, Irving Bank-Col. Trust Co.; 200 bbl. chlorate, Hamburg, Innis, Speiden & Co.; 65 csk. caustic and 327 dr. do., Hamburg, A. Klipstein & Co.; 41 dr. caustic, Hamburg, National City Bank; 300 csk. chlorate, Hamburg, E. Suter & Co.; 100 csk. alum, Hamburg, Philipp, Bauer & Co.; 150 dr. caustic, Hamburg, Peters, White & Co.

PYRIDINE—31 dr., Antwerp, H. W. Peabody & Co.; 3 dr., Rotterdam, W. M. Whittingham & Co.; 6 dr., Rotterdam, Lunham & Moore; 6 dr., Hamburg, Williamson & Co.

QUICKSILVER—312 flasks, Genoa, Order; 100 flasks, London, Order.

SAL AMMONIAC—187 bbl., Hamburg, Meteor Products Co.

SHELLAC—265 pkg., Southampton, Order; 550 cs., Calcutta, First National Bank of Boston; 500 cs., Calcutta, Brown Bros. & Co.; 100 bg., Calcutta, British Bank of South America; 50 bg., Calcutta, London & Brazilian Bank; 100 bg. refuse, Calcutta, Bank of the Manhattan Co.; 4,183 pkg., Calcutta, Order; 25 bg., London, Order; 45 bg. garnet, Hamburg, Kasebier-Chatfield Shellac Co.

SILVER SULPHIDE — 4 cs., Callao, Markt & Schaefer Co.; 1 cs., Callao, Amsinck & Co.; 6 cs., Antofagasta, Watson, Geach & Co.

SODIUM SALTS—22 cs. chlorate, Antwerp, Hummel & Robinson; 29 csk. hyposulphate, Antwerp, Mattit Chemical Co.; 62 bbl. phosphate, Antwerp, A. Klipstein & Co.; 11,144 bg. nitrate, Taltal, E. I. Du Pont de Nemours & Co.; 5,780 bg. nitrate, Iquique, E. I. Du Pont de Nemours & Co.; 90 csk. phosphate, Rotterdam, Roessler & Hasslacher Chemical Co.; 30 csk. prussiate, Rotterdam, Order; 34 csk., Rotterdam, Order; 6,679 bg. nitrate, Antofagasta, W. R. Grace & Co.

STARCH — 200 bg. potato, Rotterdam, Stein, Hall & Co.; 56 bbl., Rotterdam, L. A. Salomon & Bro.

STRONTIUM NITRATE—40 csk., Hamburg, Meteor Products Co.

SULPHUR, PRECIPITATED—10 csk., Bremen, Pfaltz & Bauer.

TALC—800 bg., Genoa, L. A. Salomon & Bros.; 1,800 bg., Genoa, Italian Discount & Trust Co.; 600 bg., Genoa, C. Mathieu; 200 bg., Bordeaux, E. M. & F. Waldo; 1,200 bg., Bordeaux, L. A. Salomon & Bros.; 1,600 bg., Bordeaux, Whittaker, Clark & Daniels; 500 bg., Genoa, Parfume de Luxe Co.

TARTAR—630 bg., Genoa, Tartar Chemical Works; 242 bg., Bordeaux, Tartar Chemical Works; 102 bg., Bordeaux, Order.

TRIPOLI — 1,012 bg., Leghorn, Orelite Co.; 84 bg., Leghorn, Continental Overseas Corp.; 1,240 bg., Leghorn, Order.

UMBER—225 bg., Naples, S. Ziltalis.

ULTRAMARINE — 10 csk., Bremen, A. Hurst & Co.

VANADIUM ORE — 505 bg., Hamburg, Watson, Glach & Co.

VERMILION—7 csk. and 6 cs., London, Pomeroy & Fischer.

WAXES—225 bg. montan, Bremen, Order; 79 bg. bees, San Antonio, D. Steengrafe; 100 cs. white, Havre, Brown Bros. & Co.

WOOL GREASE—60 csk., Bremen, C. H. Hilbert & Co.; 100 csk., Bremen, Order.

WHITING—625 bg., Dunkirk, Chatham & Phenix National Bank.

ZINC OXIDE—100 bbl., Antwerp, Brown Bros. & Co.

ZINC WHITE — 20 csk., Rotterdam, Roessler & Hasslacher Chemical Co.

Latest Quotations on Industrial Stocks

	Last Week	This Week
Air Reduction	61	64¼
Allied Chem. & Dye	62	62¾
Allied Chem. & Dye pfd.	106	106¾
Am. Ag. Chem.	12⅞	11¼
Am. Ag. Chem. pfd.	32	30⅜
American Cotton Oil	5⅞	6¼
American Cotton Oil pfd.	18	19⅛
American Cyanamid	*74	*73
Am. Drug Synd.	6	6⅛
Am. Linseed Co.	16¼	14¼
Am. Linseed pfd.	34⅜	30
Am. Smelting & Refining Co.	56	52⅞
Am. Smelting & Refining pfd.	97	97
Archer-Daniels Mid. Co., w.i.	26⅛	26
Archer-Daniels Mid. Co. pfd.	91	90½
Atlas Powder	53	*53
Casein Co. of Am.	*63	*63
Certain-Teed Products	*30	30
Commercial Solvents "A"	32	*33
Corn Products	123	124⅜
Corn Products pfd.	117	116
Davison Chem.	45¾	49⅝
Dow Chem. Co.	*47	*47
Du Pont de Nemours	126⅛	126½
Du Pont de Nemours db.	85	84½
Freeport-Texas Sulphur	11⅜	11⅛
Glidden Co.	7	7
Grasselli Chem.	*132	*132
Grasselli Chem. pfd.	*105	*145
Hercules Powder	108	108
Hercules Powder pfd.	104	104
Heyden Chem.	1⅛	*1⅛
Int'l Ag. Chem. Co.	*1⅛	*1¼
Int'l Ag. Chem. pfd.	*6	5⅜
Int'l Nickel	11⅛	11
Int'l Nickel pfd.	*78	76
Int'l Salt	78⅛	80
Mathieson Alkali	34¼	31½
Merck & Co.	*68	*68
National Lead	117	117⅜
National Lead pfd.	113⅛	112⅜
New Jersey Zinc	146	143
Parke, Davis & Co.	*79	77⅞
Pennsylvania Salt	89	88⅜
Procter & Gamble	*132	*132
Sherwin-Williams	31⅛	31½
Sherwin-Williams pfd.	*100	*100
Tenn. Copper & Chem.	8⅞	*8⅜
Texas Gulf Sulphur	56⅜	58
Union Carbide	52⅛	52
United Drug	*74¼	75½
United Dyewood	*42⅛	*42½
U. S. Industrial Alcohol	49⅜	52¼
U. S. Industrial Alcohol pfd.	*98⅜	97
Va.-Car. Chem. Co.	8⅛	7½
Va.-Car. Chem. pfd.	*25	*24

*Nominal. Other quotations based on last sale.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetone, drums	lb.	$0.25 –	$0.25½
Acetic anhydride, 85%, dr.	lb.	.38 –	....
Acid, acetic, 28%, bbl.	100 lb.	3.38 –	3.50
Acetic, 56%, bbl.	100 lb.	6.75 –	7.00
Acetic, 80%, bbl.	100 lb.	9.58 –	9.83
Glacial, 99½%, bbl.	100 lb.	12.00 –	12.78
Boric, bbl.	lb.	.10 –	....
Citric, kegs	lb.	.49 –	.50
Formic, 85%	lb.	.12 –	.14
Gallic, tech.	lb.	.45 –	.50
Hydrofluoric, 52%, carboys	lb.	.11 –	.12
Lactic, 44%, tech., light, bbl.	lb.	.11½–	.12
22% tech., light, bbl.	lb.	.05½–	.06
Muriatic, 18° tanks	100 lb.	.90 –	1.00
Muriatic, 20°, tanks	100 lb.	1.00 –	1.10
Nitric, 36°, carboys	lb.	.04½–	.05
Nitric, 42°, carboys	lb.	.05½–	.05½
Oleum, 20%, tanks	ton	18.50 –	19.00
Oxalic, crystals, bbl.	lb.	.11½–	.12
Phosphoric, 50% carboys	lb.	.07½–	.08½
Pyrogallic, resublimed	lb.	1.50 –	1.60
Sulphuric, 60°, tanks	ton	9.00 –	11.00
Sulphuric, 60°, drums	ton	13.00 –	14.00
Sulphuric, 66°, tanks	ton	15.00 –	16.00
Sulphuric, 66° drums	ton	20.00 –	21.00
Tannic, U.S.P., bbl.	lb.	.65 –	.70
Tannic, tech., bbl.	lb.	.45 –	.50
Tartaric, imp., powd., bbl.	lb.	.30½–	.31
Tartaric, domestic, bbl.	lb.	.34½–	....
Tungstic, per lb.	lb.	1.10 –	1.20
Alcohol, butyl, drums, f.o.b. works	lb.	.26 –	.28
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.78 –	....
Ethyl, 190 p'f. U.S.P., bbl.	gal.	4.75 –	....
Alcohol, methyl (see Methanol)			
Alcohol, denatured, 190 proof			
No. 1, special bbl.	gal.	.47½–	...
No. 1, 190 proof, special, dr.	gal.	.41½–	...
No. 1, 188 proof, bbl.	gal.	.48½–	...
No. 1, 188 proof, dr.	gal.	.42½–	...
No. 5, 188 proof, bbl.	gal.	.46½–	...
No. 5, 188 proof, dr.	gal.	.40½–	...
Alum, ammonia, lump, bbl.	lb.	.03½–	.04
Potash, lump, bbl.	lb.	.03¾–	.04¼
Chrome, lump, potash, bbl.	lb.	.06 –	.07
Aluminum sulphate, com. bags	100 lb.	1.40 –	1.50
Iron free bags	lb.	2.40 –	2.50
Aqua ammonia, 26°, drums	lb.	.07 –	.07½
Ammonia, anhydrous, cyl.	lb.	.30 –	.30½
Ammonium carbonate, powd. casks, imported	lb.	.09½–	.10
Ammonium carbonate, powd. domestic, bbl.	lb.	.13 –	.14
Ammonium nitrate, tech., casks	lb.	.10 –	.11
Amyl acetate tech., drums	gal.	4.50 –	4.75
Antimony Sulphuret, golden	lb.	.19 –	.20
Arsenic, white, powd., bbl.	lb.	.13½–	....
Arsenic, red, powd., kegs	lb.	.15 –	.15½
Barium carbonate, bbl.	ton	68.00 –	70.00
Barium chloride, bbl.	ton	82.00	88.00
Barium dioxide, drums	lb.	.18 –	.18½
Barium nitrate, casks	...	.07½–	.08
Blanc fixe, dry, bbl.	lb.	.04 –	.04½
Bleaching powder, f.o.b. wks., drums	100 lb.	1.25 –	....
Spot N. Y. drums	100 lb.	2.00 –	2.10
Borax, bbl.	lb.	.05½–	.05½
Bromine, cases	lb.	.28 –	.30
Calcium acetate, bags	100 lb.	4.00 –	4.05
Calcium arsenate, dr.	lb.	.15 –	.20
Calcium carbide, drums	lb.	.05½–	.05½
Calcium chloride, fused, dr. wks.	ton	21.00 –	....
Gran. drums works	ton	27.00 –	....
Calcium phosphate, mono, bbl.	lb.	.06½–	.07
Camphor, cases	lb.	.85 –	.86
Carbon bisulphide, drums	lb.	.07 –	.07½
Carbon tetrachloride, drums	lb.	.09 –	.09½
Chalk, precip.—domestic, light, bbl.	lb.	.04½–	.04½
Domestic, heavy, bbl.	lb.	.03½–	.03¾
Imported, light, bbl.	lb.	.04½–	.05
Chlorine, liquid, tanks, wks.	lb.	.04 –	.04½
Cylinders, 100 lb., wks.	lb.	.06 –	.06½
Cylinders, 100 lb., spot	lb.	.08½–	.09
Chloroform, tech., drums	lb.	.28 –	.32
Cobalt, oxide, bbl.	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks.	ton	21.00 –	24.00
Copper carbonate, bbl.	lb.	.18 –	.19
Copper cyanide, drums	lb.	.47 –	.50
Coppersulphate, dom., bbl.	100 lb.	4.80 –	4.90
Imp. bbl.	100 lb.	4.40 –	4.50
Cream of tartar bbl.	lb.	.23½–	.25½
Epsom salt, dom., tech., bbl.	100 lb.	1.75 –	2.00
Epsom salt, imp., tech., bags	100 lb.	1.00 –	....
Epsom salt, U.S.P., dom., bbl.	100 lb.	2.25 –	2.50
Ether, U.S.P., resale, dr.	lb.	.13 –	.15
Ethyl acetate, 85%, drums	gal.	.92 –	.95
Ethyl acetate, 100%, dr.	gal.	$1.05 –	$1.10
Formaldehyde, 40%, bbl.	lb.	.11½–	....
Fullers earth—f.o.b. mines	ton	18.00 –	20.00
Fusel oil, ref., drums	gal.	.... –	....
Fusel oil, crude, drums	gal.	4.25 –	....
Glaubers salt, wks., bags	100 lb.	1.20 –	1.40
Glaubers salt, imp., bags	100 lb.	.90 –	.95
Glycerine, c.p., drums extra	lb.	.17 –	....
Glycerine, dynamite, drums	lb.	.16½–	....
Glycerine, crude 80%, loose	lb.	.10¾–	.11
Iron oxide, red, casks	lb.	.12 –	.18
Lead:			
White, basic carbonate, dry, casks	lb.	.09¼–	.09½
White, basic sulphate, casks	lb.	.08¾–	.09
White, in oil, kegs	lb.	.11½–	.11½
Red, dry, casks	lb.	.10½–	.10¾
Red, in oil, kegs	lb.	.13 –	.14½
Lead acetate, white crys., bbl.	lb.	.14 –	.14½
Brown, broken, casks	lb.	.13 –	.13½
Lead arsenate, powd., bbl.	lb.	.18 –	.20
Lime-Hydrated, bg, wks.	ton	10.50 –	12.50
Bbl., wks.	ton	18.00 –	19.00
Lime, Lump, bbl.	280 lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.10¾–	.10½
Lithophone, bags	lb.	.07 –	.07¼
in bbl.	lb.	.07¼–	.07½
Magnesium carb., tech., bags	lb.	.08 –	.08½
Methanol, 95%, bbl.	gal.	.93 –	....
Methanol, 97%, bbl.	gal.	.95 –	....
Methyl-acetone, t'ks.	gal.	1.15 –	....
Nickel salt, double, bbl.	lb.	.10½–	....
Nickel salts, single, bbl.	lb.	.11½–	....
Phosgene	....	.60 –	.75
Phosphorus, red, cases	lb.	.... –	....
Phosphorus, yellow, cases	lb.	.35 –	.40
Potassium bichromate, casks	lb.	.09½–	.09¾
Potassium bromide, gran., bbl.	lb.	.19 –	.20
Potassium carbonate, 80-85%, calcined, casks	lb.	.06½–	.06¾
Potassium chlorate, powd.	lb.	.07½–	.08½
Potassium cyanide, drums	lb.	.47 –	.52
Potassium, first sorts, cask	lb.	.07½	.07¾
Potassium hydroxide (caustic potash) drums	lb.	.07 –	.07¼
Potassium iodide, cases	lb.	3.65 –	3.75
Potassium nitrate, bbl.	lb.	.07¼–	.09
Potassium permanganate, drums	lb.	.18 –	.18½
Potassium prussiate, red, casks	lb.	.60 –	.63
Potassium prussiate, yellow, casks	lb.	.28 –	.29
Salammoniac, white, gran., casks, imported	lb.	.06½–	....
Salammoniac, white, gran., bbl., domestic	lb.	.07½–	.07¾
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl.	100 lb.	1.20	1.40
Salt cake (bulk)	ton	22.00 –	23.00
Soda ash, light, 58% flat, bulk, contract	100 lb.	1.25 –	....
bags, contract	100 lb.	1.38 –	....
Soda ash, dense, bulk, contract, basis 58%	100 lb.	1.35 –	....
bags, contract	100 lb.	1.45 –	....
Soda, caustic, 76%, solid, drums contract	100 lb.	3.10 –	....
Soda, caustic, ground and flake, contracts, dr.	100 lb.	3.50 –	3.85
Soda, caustic, solid, 76% f. a. s. N. Y.	100 lb.	3.00 –	3.10
Sodium acetate, works, bbl.	lb.	.05¼–	.05½
Sodium bicarbonate, bulk	100 lb.	1.75 –	....
330-lb. bbl.	100 lb.	2.00 –	....
Sodium bichromate, casks	lb.	.07¼–	.07½
Sodium bisulphate (niter cake)	ton	6.00 –	7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04¼–	.04½
Sodium chlorate, kegs	lb.	.06½–	.07
Sodium chloride	long ton	12.00 –	13.00
Sodium cyanide, cases	lb.	.19 –	.22½
Sodium fluoride, bbl.	lb.	$0.08½–	$0.10½
Sodium hyposulphite, bbl.	lb.	.02½–	.02¾
Sodium nitrite, casks	lb.	.07¾–	......
Sodium peroxide, powd., cases	lb.	.28 –	.30
Sodium phosphate, dibasic, bbl.	lb.	.03¾–	.04
Sodium prussiate, yel. drums	lb.	.13 –	.13½
Sodium salicylic, drums	lb.	.40 –	.42
Sodium silicate (40°, drums)	100 lb.	.75 –	1.15
Sodium silicate (60°, drums)	100 lb.	1.75 –	2.00
Sodium sulphide, fused, 60-62% drums	lb.	.03 –	.04
Sodium sulphite, crys., bbl.	lb.	.03½–	.03¾
Strontium nitrate, powd., bbl.	lb.	.11½–	.12
Sulphur chloride, yel drums	lb.	.04½–	.05
Sulphur, crude	ton	18.00 –	20.00
At mine, bulk	ton	16.00 –	18.00
Sulphur, flour, bag	100 lb.	2.25 –	2.35
Sulphur, roll, bag	100 lb.	2.00 –	2.10
Sulphur dioxide, liquid, cyl.	lb.	.08 –	.08½
Tin bichloride, bbl.	lb.	.12 –	.12¼
Tin oxide, bbl.	lb.	.47 –	......
Tin crystals, bbl.	lb.	.31½–	.32
Zinc carbonate, bags	lb.	.14 –	.14½
Zinc chloride, gran, bbl.	lb.	.06½–	.06¾
Zinc cyanide, drums	lb	.37 –	.38
Zinc oxide, lead free, bbl.	lb.	.08 –	.08¼
5% lead sulphate, bags	lb.	.07¼–	......
10 to 35% lead sulphate, bags	lb.	.07 –	......
French, red seal, bags	lb.	.09¾–	......
French, green seal, bags	lb.	.10¾–	......
French, white seal, bbl.	lb.	.12 –	......
Zinc sulphate, bbl.	100 lb.	2.75 –	3.25

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.60 –	$0.70
Alpha-naphthol, ref., bbl.	lb.	.65 –	.80
Alpha-naphthylamine, bbl.	lb.	.35 –	.36
Aniline oil, drums	lb.	.16 –	.16½
Aniline salts, bbl.	lb.	.23 –	.23½
Anthracene, 80%, drums	lb.	.75 –	.80
Anthracene, 80%, imp., drums, duty paid	lb.	.65 –	.70
Anthraquinone, 25%, paste, drums	lb.	.80 –	.85
Benzaldehyde U.S.P., carboys	lb.	1.50 –	.....
f.f.c. drums	lb.	1.60 –	.....
tech, drums	lb.	75	.....
Benzene, pure, water-white, tanks, works	gal.	.23 –	....
Benzene, 90%, tanks, works	gal.	.21 –	....
Benzidine base, bbl.	lb.	.80 –	.85
Benzidine sulphate, bbl.	lb.	.75 –	....
Benzoic acid, U.S.P., kegs	lb.	.80 –	85
Benzoate of soda, U.S.P., bbl.	lb.	.65 –	.70
Benzyl chloride, 95-97%, ref., drums	lb.	.45 –	...
Benzyl chloride, tech., drums	lb.	.30 –	.35
Beta-naphthol, tech., bbl.	lb.	.21 –	.22
Beta-naphthylamine, tech.	lb.	.75 –	.80
Cresol, U.S.P., drums	lb.	.25 –	.29
Ortho-cresol, drums	lb.	.28 –	.32
Cresylic acid, 97%, works drums	gal.	.75 –	.85
95-97%, drums, works	gal.	.70 –	.75
Dichlorbenzene, drums	lb.	.06 –	.08
Diethylaniline, drums	lb.	.50 –	.60
Dimethylaniline, drums	lb.	.40 –	.41
Dinitrobenzene, bbl.	lb.	.19 –	.20
Dinitrochlorbenzene, bbl.	lb.	.21 –	.22
Dinitronaphthalen, bbl.	lb.	.30 –	.32
Dinitrophenol, bbl.	lb.	.35 –	.40
Dinitrotoluen, bbl.	lb.	.20 –	.22
Dip oil, 25%, drums	gal.	.25 –	.30
Diphenylamine, bbl.	lb.	.50 –	.52
H-acid, bbl.	lb.	.75 –	.80
Meta-phenylenediamine, bbl.	lb.	1.00 –	1.05
Michlers ketone, bbl.	lb.	3.00 –	3.50
Monochlorbenzene, drums	lb.	.08 –	.10
Monoethylaniline, drums	lb.	.95 –	1.10
Naphthalene, flake, bbl.	lb.	.06 –	.06½
Naphthalene, balls, bbl.	lb.	.06¾–	.07
Naphthionate of soda, bbl.	lb.	.60 –	.65
Naphthionic acid, crude, bbl.	lb.	.55 –	.60
Nitrobenzene, drums	lb.	.09½–	.10½
Nitro-naphthalene, bbl.	lb.	.30 –	.35
Nitro-toluene, drums	lb.	.13½–	.14½
N-W acid, bbl.	lb.	1.10 –	1.20
Ortho-amidophenol, kegs	lb.	2.30 –	2.35
Ortho-dichlorbenzene, drums	lb.	.15 –	.17
Ortho-nitrophenol, bbl.	lb.	1.20 –	1.30
Ortho-nitrotoluene, drums	lb.	.10 –	.12
Ortho-toluidine, bbl.	lb.	.18 –	.20
Para-amidophenol, base, kegs	lb.	1.30 –	....
Para-amidophenol, HCl, kegs	lb.	1.55 –	....
Para-dichlorbenzene, bbl.	lb.	.17 –	.20
Paranitroaniline, bbl.	lb.	.72 –	.75
Para-nitrotoluene, bbl.	lb.	.60 –	.65
Para-phenylenediamine, bbl.	lb.	1.45 –	1.50
Para-toluidine, bbl.	lb.	.90 –	.95
Phthalic anhydride, bbl.	lb.	.30 –	.34
Phenol, U.S.P., dr.	lb.	.26 –	.28
Picric acid, bbl.	lb.	.20 –	.22
Pyridine, dom., drums	gal.	nominal	
Pyridine, imp., drums	gal.	5.50 –	6.00
Resorcinol, tech., kegs	lb.	1.40 –	1.50

Resorcinol, pure, kegs	lb.	$2.15 - $2.25
R-salt, bbl.	lb.	.55 - .60
Salicylic acid, tech., bbl.	lb.	.32 - ....
Salicylic acid, U.S.P., bbl.	lb.	.35 - ....
Solvent naphtha, water-white, tanks	gal.	.23 - ....
Crude, tanks	gal.	.20 - ....
Sulphanilic acid, crude, bbl.	lb.	.18 - .20
Thiocarbanilide, kegs	lb.	.35 - .38
Tolidine, bbl.	lb.	1.00 - 1.05
Toluidine, mixed, kegs	lb.	.30 - .35
Toluene, tank cars, works	gal.	.24 - ....
Toluene, drums, works	gal.	.29 - ....
Xylidine, drums	lb.	.50 - ....
Xylene, pure, drums	gal.	.50 - .55
Xylene, com., drums	gal.	.34 - ....
Xylene, com., tanks	gal.	.29 - ....

Naval Stores

Rosin B-D, bbl.	280 lb.	$5.80 - ......
Rosin E-I, bbl.	280 lb.	5.80 - ......
Rosin K-N, bbl.	280 lb.	5.85 - $6.10
Rosin W.G.-W.W., bbl.	280 lb.	6.50 - 7.00
Wood rosin, bbl.	280 lb.	5.90 - 6.00
Turpentine, spirits of, bbl.	gal.	.99 - ......
Wood, steam dist., bbl.	gal.	.90 - ......
Wood, dest. dist., bbl.	gal.	.75 - ......
Pine tar pitch, bbl.	200 lb.	5.50 - ......
Tar, kiln burned, bbl.	500 lb.	11.00 - ......
Retort tar, bbl.	500 lb.	11.00 - ......
Rosin oil, first run, bbl.	gal.	.45 - ......
Rosin oil, second run, bbl.	gal.	.47 - ......
Rosin oil, third run, bbl.	gal.	.50 - ......
Pine oil, steam dist.	gal.	.65 - ......
Pine oil, pure, dest. dist.	gal.	.60 - ......
Pine tar oil, ref.	gal.	.48 - ......
Pine tar oil, crude, tanks f.o.b. Jacksonville, Fla.	gal.	.32 - .32½
Pine tar oil, double ref., bbl.	gal.	...... - .75
Pine tar, ref., thin, bbl.	gal.	...... - .25
Pinewood creosote, ref., bbl.	gal.	...... - .52

Animal Oils and Fats

Degras, bbl.	lb.	$0.04 - $0.04¼
Grease, yellow, bbl.	lb.	.06½ - .06¾
Lard oil, Extra No. 1, bbl.	gal.	.86 - .88
Neatsfoot oil, 20 deg. bbl.	gal.	1.20 - 1.25
No. 1, bbl.	gal.	.92 - .94
Oleo Stearine	..	.12¼ - ......
Oleo oil, No. 1, bbl.	lb.	.14½ - .14¾
Red oil, distilled, d.p. bbl.	lb.	.08½ - .08¾
Saponified, bbl.	lb.	.08½ - .08¾
Tallow, extra, loose	lb.	.07¾ - ......
Tallow oil, acidless, bbl.	gal.	.86½ - .87

Vegetable Oils

Castor oil, No. 3, bbl.	lb.	$0.13 - ......
Castor oil, No. 1, bbl.	lb.	.13½ - ......
Chinawood oil, bbl.	lb.	.21 - .21½
Coconut oil, Ceylon, bbl.	lb.	.09¾ - .10
Ceylon, tanks, N.Y.	lb.	.08½ - .08¾
Coconut oil, Cochin, bbl.	lb.	.10¼ - .10¾
Corn oil, crude, bbl.	lb.	.11¼ - .11½
Crude, tanks, (f.o.b. mill)	lb.	.09¼ - ......
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.09¾ - ......
Summer yellow, bbl.	lb.	.13 - ......
Winter yellow, bbl.	lb.	.13½ - .13¾
Linseed oil, raw, car lots, bbl.	gal.	.92 - ......
Raw, tank cars (dom.)	gal.	.86 - ......
Boiled, cars, bbl. (dom.)	gal.	.94 - ......
Olive oil, denatured, bbl.	gal.	1.10 - 1.12
Sulphur, (foots) bbl.	lb.	.08½ - .08¾
Palm, Lagos, casks	lb.	.07½ - ......
Niger, casks	lb.	.07¼ - ......
Palm kernel, bbl.	lb.	.08¾ - .09
Peanut oil, crude, tanks (mill)	lb.	.13 - ....
Peanut oil, refined, bbl.	lb.	.14½ - ....
Perilla, bbl.	lb.	.14¼ - .14½
Rapeseed oil, refined, bbl.	gal.	.73 - .75
Rapeseed oil, blown, bbl.	gal.	.82 - ......
Sesame, bbl.	lb.	.12¼ - .12½
Soya bean (Manchurian), bbl.	lb.	.10¼ - ......
Tank, f.o.b. Pacific coast	lb.	.09¼ - ......
Tank, (f.o.b. N.Y.)	lb.	.09½ - ......

Fish Oils

Cod, Newfoundland, bbl.	gal.	$0.66 - $0.68
Menhaden, light pressed, bbl.	gal.	.62 - ......
White bleached, bbl.	gal.	.64 - ......
Blown, bbl.	gal.	.69 - ......
Crude, tanks (f.o.b. factory	gal.	.47½ - ......
Whale No. 1 crude, tanks, coast	lb.	...... - ......
Winter, natural, bbl.	gal.	.75 - .76
Winter, bleached, bbl.	gal.	.78 - .79

Oil Cake and Meal

Coconut cake, bags	ton	$32.00 - $33.00
Copra, sun dried, bags, (c.i.f.)	lb.	.05½ - ....
Sun dried Pacific coast	lb.	.04¾ - ....
Cottonseed meal, f.o.b. mills	ton	40.00 - 41.00
Linseed cake, bags	ton	40.00 - ....
Linseed meal, bags	ton	44.00 - ....

Dye & Tanning Materials

Albumen, blood, bbl.	lb.	$0.45 - $0.50
Albumen, egg, tech, kegs	lb.	.95 - .97
Cochneal, bags	lb.	.32 - .34
Cutch, Borneo, bales	lb.	.04 - .04½
Cutch, Rangoon, bales	lb.	.15 - .16
Dextrine, corn, bags	100 lb.	4.09 - 4.36
Dextrine gum, bags	100 lb.	4.44 - 4.71
Divi-divi, bags	ton	38.00 - 39.00
Fustic, sticks	ton	30.00 - 35.00
Fustic, chips, bags	lb.	.04 - .05
Gambier com. cs.	lb.	.08½ - .09
Logwood, sticks	ton	25.00 - 26.00
Logwood, chips, bags	lb.	.02½ - .03
Sumac, leaves, Sicily, bags	ton	80.00 - 85.00
Sumac, ground, bags	ton	$75.00 - $80.00
Sumac, domestic, bags	ton	40.00 - 42.00
Starch, corn, bags	100 lb.	3.57 - 3.67
Tapioca flour, bags	lb.	.07 - .07½

Extracts

Archil, conc., bbl.	lb.	$0.16½ - $0.20
Chestnut, 25% tannin, tanks.	lb.	.02 - .03
Divi-divi, 25% tannin, bbl.	lb.	.04 - .05
Fustic, crystals, bbl.	lb.	.20 - .22
Fustic, liquid, 42°, bbl.	lb.	.08 - .09
Gambier, liq., 25% tannin, bbl.	lb.	.09 - .09½
Hematine crys., bbl.	lb.	.14 - .18
Hemlock, 25% tannin, bbl.	lb.	.03½ - .04
Hypernic, solid, drums	lb.	.24 - .26
Hypernic, liquid, 51°, bbl.	lb.	.09½ - .10½
Logwood, crys., bbl.	lb.	.14 - .15
Logwood, liq., 51°, bbl.	lb.	.07½ - .08
Quebracho, solid, 65% tannin, bbl.	lb.	.04½ - .05
Sumac, dom., 51°, bbl.	lb.	.06½ - .07½

Dry Colors

Blacks-Carbongas, bags, f.o.b. works, spot	lb.	$0.14 - $0.18
Lampblack, bbl.	lb.	.12 - .40
Mineral, bulk	ton	35.00 - 45.00
Blues-Bronze, bbl.	lb.	.50 - .55
Prussian, bbl.	lb.	.50 - .55
Ultramarine, bbl.	lb.	.08 - .35
Browns, Sienna, Ital., bbl.	lb.	.06 - .14
Sienna, Domestic, bbl.	lb.	.03½ - .04
Umber, Turkey, bbl.	lb.	.04 - .04½
Greens-Chrome, C.P. Light, bbl.	lb.	.30 - .32
Chrome, commercial, bbl.	lb.	.12 - .12½
Paris, bulk	lb.	.28 - .30
Reds, Carmine No. 40, tins	lb.	4.50 - 4.70
Oxide red, casks	lb.	.10 - .14
Para toner, kegs	lb.	1.00 - 1.10
Vermilion, English, bbl.	lb.	1.15 - 1.20
Yellow, Chrome, C.P. bbls.	lb.	.17½ - .18
Ocher, French, casks	lb.	.02¼ - .03

Waxes

Bayberry, bbl.	lb.	$0.25 - $0.26
Beeswax, crude, Afr. bg.	lb.	.21½ - .22
Beeswax, refined, light, bags	lb.	.32 - .34
Beeswax, pure white, cases	lb.	.40 - .41
Candellila, bags	lb.	.23½ - .24
Carnauba, No. 1, bags	lb.	.36 - .38
No. 2, North Country, bags	lb.	.23½ - .24
No. 3, North Country, bags	lb.	.16½ - .17
Japan, cases	lb.	.16¾ - .17
Montan, crude, bags	lb.	.05 - ...
Paraffine, crude, match, 105-110 m.p., bbl.	lb.	.04¼ - .04¾
Crude, scale 124-126 m.p. bags	lb.	.03 - ....
Ref., 118-120 m.p., bags	lb.	.03¼ - ....
Ref., 125 m.p., bags	lb.	.03½ - ....
Ref, 128-130 m.p., bags	lb.	.03¾ - ....
Ref., 133-135 m.p., bags	lb.	.04½ - .04¾
Ref., 135-137 m.p., bags	lb.	.05¼ - .05½
Stearic acid, sgle pressed, bags	lb.	.12½ - .12¾
Double pressed, bags	lb.	.13 - .13¼
Triple pressed, bags	lb.	.14¼ - .14½

Fertilizers

Ammonium sulphate, bulk f.o.b. works	100 lb.	$3.20 - $3.25
F.a.s. double bags	100 lb.	3.40 - 3.50
Blood, dried, bulk	unit	4.40 - 4.60
Bone, raw, 3 and 50, ground	ton	28.00 - 30.00
Fish scrap, dom., dried, wks.	unit	..... - .....
Nitrate of soda, bags	100 lb.	2.40 - 2.52½
Tankage, high grade, f.o.b. Chicago	unit	3.25 - 3.35
Phosphate rock, f.o.b. mines, Florida pebble, 68-72%	ton	4.00 - 4.50
Tennessee, 78-80%	ton	7.75 - 8.00
Potassium muriate, 80%, bags	ton	34.55 - ......
Potassium sulphate, bags basis 90%	ton	43.67 - ......
Double manure salt	ton	25.72 - ......
Kainit	ton	7.22 - ......

Crude Rubber

Para—Upriver fine	lb.	$0.22¼ - ......
Upriver coarse	lb.	.18½ - ......
Upriver caucho ball	lb.	.19½ - ......
Plantation—First latex crepe	lb.	.26¼ - ......
Ribbed smoked sheets	lb.	.26¼ - ......
Brown crepe, thin, clean	lb.	.24¼ - ......
Amber crepe No. 1	lb.	.25½ - ......

Gums

Copal, Congo, amber, bags	lb.	$0.10 $0.15
East Indian, bold, bags	lb.	.21 - .22
Manila, pale, bags	lb.	.19 - .20
Pontinak, No. 1 bags	lb.	.19 - .20
Damar, Batavia, cases	lb.	.25 - .25½
Singapore, No. 1, cases	lb.	.32 - .33
Singapore, No. 2, cases	lb.	.21½ - .22
Kauri, No. 1, cases	lb	.64 - .66
Ordinary chips, cases	lb.	.21 - .23
Manjak, Barbados, bags	lb.	.09 - .09¼

Shellac

Shellac, orange fine, bags	lb.	$0.64 - $0.65
Orange superfine, bags	lb.	.66 - .67
A. C. garnet, bags	lb.	.65 - ....
Bleached, bonedry	lb.	.72 - .73
Bleached, fresh	lb.	.60 - ....
T. N., bags	lb.	.61 - ....

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b., Quebec	sh. ton	$375.00 - $500.00
Asbestos, shingle, f.o.b., Quebec	sh. ton	$55.00 - $60.00
Asbestos, cement, f.o.b., Quebec	sh. ton	20.00 - 25.00
Barytes, grd., white, f.o.b. mills, bbl.	net ton	16.00 - 20.00
Barytes, grd., off-color, f.o.b. mills bulk	net ton	13.00 - 15.00
Barytes, floated, f.o.b. St. Louis, bbl.	net ton	28.00 - ......
Barytes, crude f.o.b. mines, bulk	net ton	8.00 - 10.00
Casein, bbl., tech.	lb.	.15 - .16
China clay (kaolin) crude, f.o.b. Ga.	net ton	6.00 - 8.00
Washed, f.o.b. Ga.	net ton	8.00 - 9.00
Powd., f.o.b. Ga.	net ton	14.00 - 20.00
Crude f.o.b. Va.	net ton	6.00 - 8.00
Ground, f.o.b. Va.	net ton	13.00 - 19.00
Imp., lump, bulk	net ton	15.00 - 20.00
Imp., powd.	net ton	45.00 - 50.00
Feldspar, No. 1 pottery	long ton	7.50 - ......
No. 2 pottery	long ton	6.00 - ......
No. 1 soap	long ton	8.50 - ......
No. 1 Canadian, f.o.b. mill	long ton	18.00 - 20.00
Graphite, Ceylon, lump, first quality, bbl.	lb.	.06 - .06½
Ceylon, chip, bbl.	lb.	.04½ - .05
High grade amorphous crude	ton	15.00 - 30.00
Gum arabic, amber, sorts, bags	lb.	.13½ - .14½
Gum tragacanth, sorts, bags	lb.	.50 - .55
No. 1, bags	lb.	1.40 - 1.45
Kieselguhr, f.o.b. Cal.	ton	40.00 - 42.00
F.o.b. N.Y.	ton	50.00 - 55.00
Magnesite, crude, f.o.b. Cal.	ton	14.00 - 15.00
Pumice stone, imp., casks	lb.	.03 - .05½
Dom., lump, bbl.	lb.	.05 - .05½
Dom., ground, bbl.	lb.	.05½ - .06
Silica, glass sand, f.o.b. Ind.	ton	2.00 - 2.50
Silica, sand blast, f.o.b. Ind.	ton	2.50 5.00
Silica, amorphous, 250-mesh, f.o.b. Ill.	ton	17.00 - 17.50
Silica, glass sand, f.o.b. Ill.	ton	1.50 - 3.00
Soapstone, coarse, f.o.b. Vt., bags	ton	7.00 - 8.00
Talc, 200 mesh, f.o.b., Vt., bags, extra	ton	6.00 - 8.00
Talc, 200 mesh, f.o.b. Ga., bags	ton	7.00 - 9.00
Talc, 325 mesh, f.o.b. New York, bags	ton	14.75 - 15.25

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$2.50 - 2.75
Corning	bbl.	1.45 - ......
Cabell	bbl.	1.35 - ......
Somerset	bbl.	1.25 - ......
Illinois	bbl.	1.47 - ......
Indiana	bbl.	1.48 - ......
Kansas and Oklahoma, 28 deg.	bbl.	.50 - ......
California, 35 deg. and up	bbl.	.76 - ......

Gasoline, Etc.

Motor gasoline, steel bbls.	gal.	$0.16½ - ......
Naphtha, V. M. & P. deod, steel bbls.	gal	.15½ - ......
Kerosene, ref. tank wagon	gal.	.14 - ......
Bulk, W.W. delivered, N.Y.	gal.	.06 - ......
Lubricating oils:		
Cylinder, Penn., dark	gal.	.22½ - ......
Bloomless, 30@31 grav.	gal.	.17½ - ......
Paraffin, pale	gal.	.16 - .17
Spindle, 200, pale	gal.	.20 - .20½
Petrolatum, amber, bbls.	lb.	.03½ - .04
Paraffine wax (see waxes)		

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140-145
Chrome brick, f.o.b. Eastern shipping points	ton	50-52
Chrome cement, 40-50% Cr_2O_3	ton	23-27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	45-48
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	38-42
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65-68
9-in. arches, wedges and keys	ton	80-85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	53-55
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	53-54
F.o.b. Mt. Union, Pa.	1,000	45-47
Silicon carbide refract. brick, 9-in.	1,000	1,100.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N.Y.	ton	$200.00 - $225.00
Ferrochromium, per lb. of Cr, 1-2% C	lb.	.28 - .30
4-6% C	lb.	.12 - ...
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	110.00 - ......
Spiegeleisen, 19-21% Mn.	gr. ton	45.00 - 47.00
Ferromolybdenum, 50-60% Mo, per lb Mo.	lb.	2.00 - 2.50
Ferrosilicon, 10-12%	gr. ton	43.00 - 50.00
50%	gr. ton	85.00 - ......

Ferrotungsten, 70-80%, per lb. of W	lb.	\$0.88 @ \$0.90
Ferro-uranium, 35-50% of U. per lb. of U	lb.	4.50 - ....
Ferrovanadium, 30-40%, per lb. of V	lb.	3.50 - 4.50

Ores and Semi-finished Products

Bauxite, dom. crushed dried, f.o.b. shipping points	ton	\$5.50 -	\$8.75
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 -	23.00
C.i.f. Atlantic seaboard	ton	21.00 -	?5.00
Coke, fdry., f.o.b. ovens	ton	5.00 -	5.50
Coke, furnace, f.o.b. ovens	ton	3.75 -	4.00
Fluorspar, gravel, f.o.b. mines' Illinois	ton	23.50 -	....
Ilmenite, 52% TiO_2	lb.	.01 -	.01½
Manganese ore, 50% Mn c.i.f. Atlantic seaport	unit	.40 -	....
Manganese ore, chemical (MnO_2)	ton	75.00 -	80.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.75 -	....
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 -	.08
Pyrites, Span., fines, c.i.f Atl. seaport	unit	.11½-	.12
Pyrites, Span., furnace size c.i.f. Atl. seaport	unit	.11½-	.12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12 -	....
Rutile, 95% TiO_2	lb.	.12 -	....
Tungsten, scheelite, 60% WO_3 and over	unit	9.00 -	9.50
Tungsten, wolframite, 60% WO_3	unit	8.50 -	9.00
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 -	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	2.25 -	2.50
Vanadium pentoxide, 99%	lb.	12.00 -	14.00
Vanadium ore, per lb. V_2O_5	lb.	.75 -	1.00
Zircon	ton	50.00 -	....

Non-Ferrous Materials

	Cents per Lb.
Copper, electrolytic	12⅜
Aluminum, 98 to 99%	25-27
Antimony, wholesale, Chinese and Japanese	8- 8¼
Nickel, 99%	27-32
Monel metal, shot and blocks	32.00
Monel metal, ingots	38.00
Monel metal, sheet bars	45.00
Tin, 5-ton lots, Straits	42.50
Lead, New York, spot	6.85
Lead, E. St. Louis, spot	6.55
Zinc, spot, New York	6.62½
Zinc, spot, E. St. Louis	6.27½

Other Metals

Silver (commercial)	oz.	\$0.63⅜
Cadmium	lb.	.80
Bismuth (500 lb. lots)	lb.	2.55
Cobalt	lb.	3.00-3.25
Magnesium, ingots, 99%	lb.	1.25-.....
Platinum	oz.	116.00
Iridium	oz.	275.00@300.00
Palladium	oz.	80.00
Mercury	75 lb.	62.00

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	19.25
Copper bottoms	29.75
Copper rods	19.75
High brass wire	18.00
High brass rods	16.25
Low brass wire	20.25
Low brass rods	20.50
Brazed brass tubing	23.50
Brazed bronze tubing	27.00
Seamless copper tubing	25.50
Seamless high brass tubing	24.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

Copper, heavy and crucible	8.75@ 9.00
Copper, heavy and wire	11.00@ 11.25
Copper, light and bottoms	9.00@ 9.25
Lead, heavy	5.50@ 5.62½
Lead, tea	3.50@ 3.75
Brass, heavy	6.25@ 6.50
Brass, light	5.25@ 5.50
No. 1 yellow brass turnings	5.75@ 6.00
Zinc scrap	3.75@ 4.00

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	\$3.54	\$3.54
Soft steel bars	3.54	3.54
Soft steel bar shapes	3.54	3.54
Soft steel bands	4.39	4.39
Plates, ¼ to 1 in. thick	3.64	3.64

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Alabama

GADSDEN—The Gadsden Clay Products Co. is planning for extensions in its plant, to include the erection of two new kilns and the installation of additional machinery. Gordon Hood is general manager.

Arkansas

BAUXITE—The American Bauxite Co. has preliminary plans under way for enlargements in its local plant, including the erection of a number of buildings and the installation of additional machinery, estimated to cost in excess of \$150,000. The present works have a capacity of about 30,000 tons of bauxite ore per month.

STEPHENS—The Houston Oil Co., Houston, Tex., is said to be planning for the construction of a new oil-refining plant in this section, and will have arrangements consummated at an early date.

FAYETTEVILLE—The Ozark White Lime Co. has work in progress on a new lime hydrating plant and expects to have equipment installed and the unit ready for operation at an early date. The plant will have an initial capacity of close to 8,500 bbl. per month.

California

MERCED—The Yosemite Portland Cement Co. has commenced foundations for the initial buildings of its proposed new plant in this section, consisting of two structures, 36x144 ft. and 65x160 ft., and will start work on other buildings at an early date. It is purposed to build a bunker storage plant at Jenkins Hill with capacity of 1,000 tons. The new plant is estimated to cost close to \$1,000,000, with machinery. M. Steinmetz is chief engineer, in charge.

Connecticut

NORWICH—The H. H. Allyn Rubber Corp., Colonial Trust Bldg., Philadelphia, Pa., manufacturer of inner tubes for automobile tires, has leased a portion of the C. B. Rogers Bldg., Norwich, for the establishment of a new plant. It is purposed to install equipment for an initial output of about 1,000 self-sealing inner tubes per day.

Florida

TAMPA—The Imperial Petroleum Corp., recently formed with a capital of \$1,000,000, has plans under way for the construction of a new oil storage and distributing plant, estimated to cost in excess of \$200,000, including equipment. The company will succeed to the property and business of the Imperial Petroleum Co. of Tampa. W. F. Miller is president of the new organization.

Georgia

MACON—The Schuster-Adams Chemical Co., recently formed with a capital of \$1,000,000, has preliminary plans in progress for the erection of a new local plant for the manufacture of sulphuric acid, bicarbonate of soda and salicylate of soda, as well as other miscellaneous chemical specialties. The initial works is estimated to cost in excess of \$125,000, including equipment. The new company is headed by Dr. Richard Schuster, Jr., Hoke Smith and C. M. Adams, all of Macon.

Illinois

CHICAGO—Gutmann & Co., 1511 Webster Ave., operating a leather tannery, have construction in progress on a new 1-story addition, to cost about \$150,000, including equipment, and purposes to have the structure ready for machinery at an early date. I. S. Stein, 35 South Dearborn St., is architect. E. J. Gutmann heads the company.

Indiana

SOUTH BEND—The LaSalle Paper Co. has awarded a general contract to Kuehn & Jordon, 725 Welber St., for the construction of its proposed new mill on the St. Joe River, comprising a main 1- and 2-story structure, with a number of auxiliary buildings, estimated to cost close to \$1,000,000, with machinery. Freyermuth & Maurer, Farmers' Trust Bldg., South Bend, are architects and engineers.

Kentucky

LOUISVILLE—The Standard Sanitary Mfg. Co., Bessemer Bldg., Pittsburgh, Pa., manufacturer of enameled iron sanitary ware, etc., is taking bids for the construction of a new 5-story addition to its local plant at 6th and Shipp Sts., to be 50x95 ft., estimated to cost approximately \$40,000. D. X. Murphy & Brothers, Louisville Trust Bldg., are architects. The company is also having plans drawn for the erection of other units at this plant.

Louisiana

MONROE—The Sweet Glass Co., P. O. Box 430, Monroe, recently organized, has plans nearing completion for the construction of a new local plant for the manufacture of glass jars, containers, headlight lenses and kindred products, consisting of a main building, with smaller adjoining structures, estimated to cost in excess of \$85,000, with machinery. A steam power house will also be constructed. A list of equipment for installation is being arranged. A. H. Sweet is president and general manager. Officials of the company, headed by Mr. Sweet, have also organized another interest, to be known as the Southern Glass Novelty Co., for which it is purposed to construct another plant on local site, for the production of a line of glass specialties.

BOGALUSA—The Union Bag & Paper Corp., Woolworth Bldg., New York, N. Y., is reported to have preliminary plans under advisement for the construction of a new mill near Bogalusa, estimated to cost more than \$350,000, including equipment.

Maryland

AMCELLE (Cumberland)—The American Cellulose & Chemical Mfg. Co., Ltd., has tentative plans under consideration for the construction of a new building at its local plant, to cost in excess of \$125,000. Guy Leonard is general manager.

Michigan

DETROIT—The Mulkey Salt Co., Dix St., has filed plans for the construction of a new 2-story salt mill, estimated to cost approximately \$37,000. Albert Kahn, Marquette Bldg., is architect.

LANSING—The Board of Water Commissioners has plans in preparation and will soon take bids for the construction of a water-softening plant, at the municipal waterworks, estimated to cost approximately \$350,000. Alvord, Burdick & Howson, 8 South Dearborn St., Chicago, Ill., are engineers.

PORT HURON—The Dunn Sulphite & Paper Co. has acquired property on the St. Clair River, fronting on the line of the Grand Trunk R.R., as a site for a new pulp and paper mill, estimated to cost approximately \$500,000, including machinery. Theodore Dunn, Detroit, is president.

DETROIT—The Great Western Smelting & Refining Co., 5201 Loraine St., has filed plans and will commence the immediate erection of a new 1-story plant, 192x210 ft., on Russell St., near Highland Ave., to cost approximately \$150,000.

Missouri

NEVADA—The Vernon Asphalt Co., recently formed with a capital of \$150,000, is perfecting plans for the establishment of a local mill for the production of asphalt, utilizing raw materials from property in this district, and will install mining apparatus, mixing machinery and equipment for reducing asphaltic sandstone to oil and asphalt oil. John A. Lohmeyer, Joplin, Mo.; and L. A. Johnson, secretary Nevada.

ST. LOUIS—The Ford Motor Co., Highland Park, Detroit, Mich., has secured an option on lead properties in St. Francois and Washington Counties, owned by the Irondale Mining Co. and the St. Francois County Prospecting Co., and has tentative plans for the construction of a new works

for the production of finished lead, to be used at its automobile plants. A consideration of $1,250,000 has been asked for the lands; the proposed plant will cost in excess of $500,000, with equipment.

ST. CHARLES—The St. Charles Gas Co. has commenced work on extensions and improvements at its artificial gas plant on Washington St. New water-gas equipment will be installed to replace present coal-gas apparatus, with new holder and other equipment.

New Jersey

NEWARK—The General Alloy Co., 186 New Jersey Railroad Ave., has filed plans for the erection of a new 1-story building at its plant to cost about $10,000.

KEASBEY—Fire, Oct. 20, destroyed a large portion of the plant of the National Fireproofing Co., manufacturer of hollow tile, etc., with loss estimated at close to $500,000, including equipment. Headquarters of the company are in the Fulton Bldg., Pittsburgh, Pa.

TRENTON—The Trenton Potteries Co., manufacturer of sanitary ware, has filed plans for the erection of a 1-story addition.

New York

BROOKLYN—The Federal Composition & Paint Co., 263 42nd St., is taking bids for the erection of a new 1-story addition to cost about $13,000. Lockwood, Greene & Co., 101 Park Ave., New York, are engineers.

DUNKIRK—The Atlas Steel Corp. has commenced the dismantling of its branch plant at Charleroi, Pa., formerly owned by the Youngstown Sheet & Tin Plate Co., and will remove the equipment to the Dunkirk mill. The latter plant will be extended for the additional machinery. It is purposed to discontinue operations entirely at the Charleroi works.

BUFFALO—The Iroquois Gas Corp. has commenced the construction of the first unit of its new artificial gas plant on the Mineral Springs Road, near the city limits, with installation to consist of three watergas generators, a battery of twenty coalgas retorts, coke works and bagging plant, and auxiliary structures. The plant will have an initial capacity of 13,500,000 cu.ft. per day. A 5,000,000-cu.ft. capacity gas holder will also be built. The entire works will cost approximately $3,500,000, and will be expanded at a later date.

Ohio

SANDUSKY—Officials of the Diamond Fertilizer Co. have organized a subsidiary to be known as the Crescent Chemical Co., to specialize in the production of sulphuric acid and affiliated products. It is purposed to establish a local plant at an early date.

CLEVELAND—The Billings-Chapin Co., 1163 East 40th St., manufacturer of paints, varnishes, etc., has plans in preparation for the construction of a new plant unit, to be 3-story and basement, estimated to cost approximately $100,000, with equipment. It is purposed to call for bids at an early date. Perry & Webster, Inc., 31 Union Sq. West, New York, N. Y., is architect. Lockwood, Greene & Co., Hanna Bldg., Cleveland, are consulting engineers. Nathaniel D. Chapin is president.

DAYTON—The Elam Paper Co., Marion, Ind., has plans under way for the construction of a new 2-story plant, totaling about 70,000 sq.ft. of floor space, on local site, for its proposed new mill, replacing the present works at Marion, which will be removed here. It is expected to call for bids at an early date.

CLEVELAND—The Cleveland Steel Tube Co., Miles Ave., has preliminary plans in progress for the erection of a large addition to its plant, estimated to cost in excess of $100,000, with equipment.

Oregon

OREGON CITY—The Hawley Pulp & Paper Co. has preliminary plans under consideration for the rebuilding of the portion of its plant destroyed by fire, Oct. 9, with loss estimated in excess of $500,000 with machinery. The machine and beater departments were entirely demolished.

Pennsylvania

BLAIRSVILLE—The National Plate Glass Works, Inc., has commenced initial work on a new plant unit, to consist of a number of buildings estimated to cost close to $3,500,000, including machinery. The company is operating at the former works of the Columbia Glass Co. A general contract for the erection has been awarded to the John F. Casey Co., Union Arcade, Pittsburgh.

NAZARETH—The Phœnix Portland Cement Co. has plans in preparation for the construction of two new buildings at its local plant for machine and sackhouse service, to replace a portion of its works destroyed by fire a number of weeks ago with loss estimated at $500,000. Bids for the new structures will soon be asked.

Tennessee

NASHVILLE—The Nashville Paper Stock Co., 2nd Ave. and Church St., has awarded a general contract to Maugaus & Bell, Murfreesboro, Tenn., for the constructions of a new local plant to cost about $50,000, on which work will be commenced at once. D. L. Ledbetter is secretary, in charge.

Texas

HASKELL—Fire, Oct. 14, destroyed a portion of the mill of the Western Cotton Oil Co., with loss estimated at close to $100,000, including machinery. It is planned to rebuild.

Washington

ANACORTES — The Consolidated Paper Corp., Tacoma, Wash., has acquired a local mill, formerly used for the manufacture of cement, and will remodel and improve the property for the production of waterproof and other paper products. Present machinery will be used where possible and considerable additional equipment installed. O. H. Fair is president.

TACOMA—The Tacoma Gas & Fuel Co. is perfecting plans for the construction of a new artificial gas plant on South River St., with initial capacity of about 3,000,000 cu.ft. per day, estimated to cost in excess of $1,000,000, with subsidiary coke and other works. Daniel L. Young is president.

Wisconsin

PARK FALLS—The Flambeau Paper Co. has revised plans in preparation for the construction of its proposed new plant unit, consisting of a main 1-story and basement building, with smaller adjoining structures, estimated to cost $175,000, with equipment. Brust & Phillips, 405 Broadway, Milwaukee, are architects. C. E. Perry is president.

New Companies

WILMINGTON OIL & FERTILIZER Co., Wilmington, N. C.; fertilizers, oils, etc.; $200,000. Incorporators: Horace and Oscar Pearsall, both of Wilmington.

HARTFORD TISSUE MILLS, INC., East Hartford, Conn.; tissue and other paper products; $50,000. Incorporators: Edward Dugan and Leo J. Noonan, 36 Pearl St., Hartford, Conn.

KEYSTONE CHEMICAL PRODUCTS CORP., Wilmington, Del.; chemicals and chemical byproducts; $100,000. Representative: Delaware Charter Co., 904 Market St., Wilmington.

ARROW PETROLEUM CORP., Los Angeles, Calif.; refined petroleum products; $5,000,000. Incorporators: J. F. Jacob, D. W. R. Dunton and A. H. Koebig, Jr. Representative: Dunham & Thompson, 219 City Savings Bank Bldg., Pasadena, Calif.

NEMADJI TILE & POTTERY Co., Moose Lake, Minn.; pottery, tiling and other ceramic products; $50,000. Incorporators: Frank Johnson, Moose Lake; and John B. Sermer, Barnum, Minn.

WESTWOOD OIL Co., 127 North Dearborn St., Chicago, Ill.; refined oil products; $150,000. Incorporators: Rudolph Kohn, C. A. Teller and Lewis D. Levit.

COX, HALL & COX LEATHER Co., Boston, Mass.; leather products; 1,000 shares of stock, no par value. Oliver Hall is president, and George E. Cox, North Adams, Mass., treasurer and representative.

BLENIO-RUSSELL LABORATORIES, INC., New York, N. Y.; chemicals and chemical byproducts; 50 shares of stock, no par value. Incorporators: G. Blenio, J. T. Malia and E. B. Tracy. Representative: T. L. Ernst, 140 Nassau St., New York.

STANDARD PAPER Co., INC., San Francisco, Calif.; paper products; $100,000. Incorporators: George A. Connolly, C. M. Treacy and Arthur J. Harsfeld. Representative: Jerome Politzer, Mills Bldg., San Francisco.

CHESTER CARBON Co., Monroe, La.; carbon black and kindred products; $250,000. Incorporators: Percy Putnam and L. B. Adams, both of Monroe.

ORIENT SOAP Co., West New York, N. J.; soaps and kindred specialties; $100,000. Incorporators: Joseph J. Constantian and John G. Kazanjian, 235 7th St., West New York. The last noted is representative.

BEST KID Co., INC., Philadelphia, Pa.; operate a leather tannery; $500,000. Representative: Corporation Guarantee & Trust Co., Land Title Bldg., Philadelphia.

EVERSHINE Co., Atlanta, Ga.; metal polishes, etc.; organized. The company is headed by Dr. T. Poole Maynard and M. P. Phipps, both of Atlanta.

CONSOLIDATED PETROLEUM CORP., New York, N. Y.; refined petroleum products; $5,000,000. Incorporators: Arnold Merkel, Allen Branin and William Stone. Representative: Colonial Charter Co., Ford Bldg., Wilmington, Del.

MILLARD RUBBER Co., New York, N. Y.; rubber products; $20,000. Incorporators: W. F. D. Noble and C. Kisselhof. Representative: E. T. Manning, 136 Liberty St., New York.

L. J. STEINHARDT & Co., INC., Newark, N. J.; operate leather tanneries; $125,000. Incorporators: John H. Meister and R. Flaster. Representative: Bilder & Bilder, 790 Broad St., Newark.

DURABLE PAINT Co., Brooklyn, N. Y.; paints, oils, varnishes, etc.; $50,000. Incorporators: J. Hudson, R. A. and J. J. Keegan. Representative: L. H. Hahlo, 233 Broadway, New York.

CAROLINA LIME Co., Charleston, S. C.; lime products; organized. The company is headed by H. M. and E. D. Hutchinson, both of Charleston.

ENTERPRISE RUBBER Co., Yardville, N. J.; rubber products; $100,000. Incorporators: John Masich, Leo McCue and J. E. Catana. Representative: J. Irving Davidson, American Mechanic Bldg., Trenton, N. J.

CHARLES A. GREEN & SON, INC., Philadelphia; being organized to manufacture fertilizers, soda products, etc.; application for a state charter will be made on Nov. 5. The company is headed by Charles A. and William H. Green, and Charles C. Batzig, Jr. Representative: William E. McCall, Jr., Stephen Girard Bldg., Philadelphia.

F. G. LESLIE PAPER Co., Wilmington, Del.; paper products; $200,000. Representative: Corporation Service Co., Equitable Bldg., Wilmington.

HUGO FALCK & Co., LTD., New York, N. Y.; chemicals and allied products, metal ores, etc.; $250,000. Incorporators: P. Berner, H. Riegelman and S. H. Hofstadter. Representative: Nordlinger & Riegelman, 60 Wall St., New York.

Industrial Notes

THE FULLER ENGINEERING Co., Fullerton, Pa., announces that an agreement has been consummated whereby it will act as sole licensee in the United States and Canada for all new business of the Quigley Fuel Systems, Inc. The engineering personnel of the Quigley Fuel Systems, Inc., has become associated with the Fuller Engineering Co. and is now in a better position to render more complete engineering service. In the future all business of the Quigley Fuel Systems, Inc., will be conducted through the main and branch offices of the Fuller Engineering Co.

NOBEL INDUSTRIES, LTD., Nobel House, Buckingham Gate, London, S. W., England, announces that its constituent company, the Continuous Reaction Co., Ltd., has removed its offices from 155 Church Road, Battersea, S. W. 11, to Newton Works, Hyde, Cheshire, England.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

ANILINE. Bydgoszcz, Poland. Purchase.—7974.

CHLORINE GAS. Stockholm, Sweden. Purchase.—7991.

PAINTS, CHROME. Bydgoszcz, Poland. Purchase.—7974.

PAINTS AND VARNISHES. Cairo, Egypt. Agency.—7990.

POTASH, BICHROMATE. Cairo, Egypt. Agency.—7990.

ROSIN for paper. Stockholm, Sweden. Agency.—7992.

SULPHUR in cargo lots of 4,000 tons. Stockholm, Sweden. Agency.—7993.

TURPENTINE, essence of. Cairo, Egypt. Agency.—7990.

TURPENTINE (gum) and rosin of all kinds. Stockholm, Sweden. Agency.—7993.